UT to Sandy Creek

Randolph County, North Carolina

First Year Monitoring Report
State Construction ID: 040611601
USGS HUC 03030003020010
EEP-08030

Prepared for:

NCDENR Ecosystem Enhancement Program
2728 Capital Blvd., Suite 1H 103
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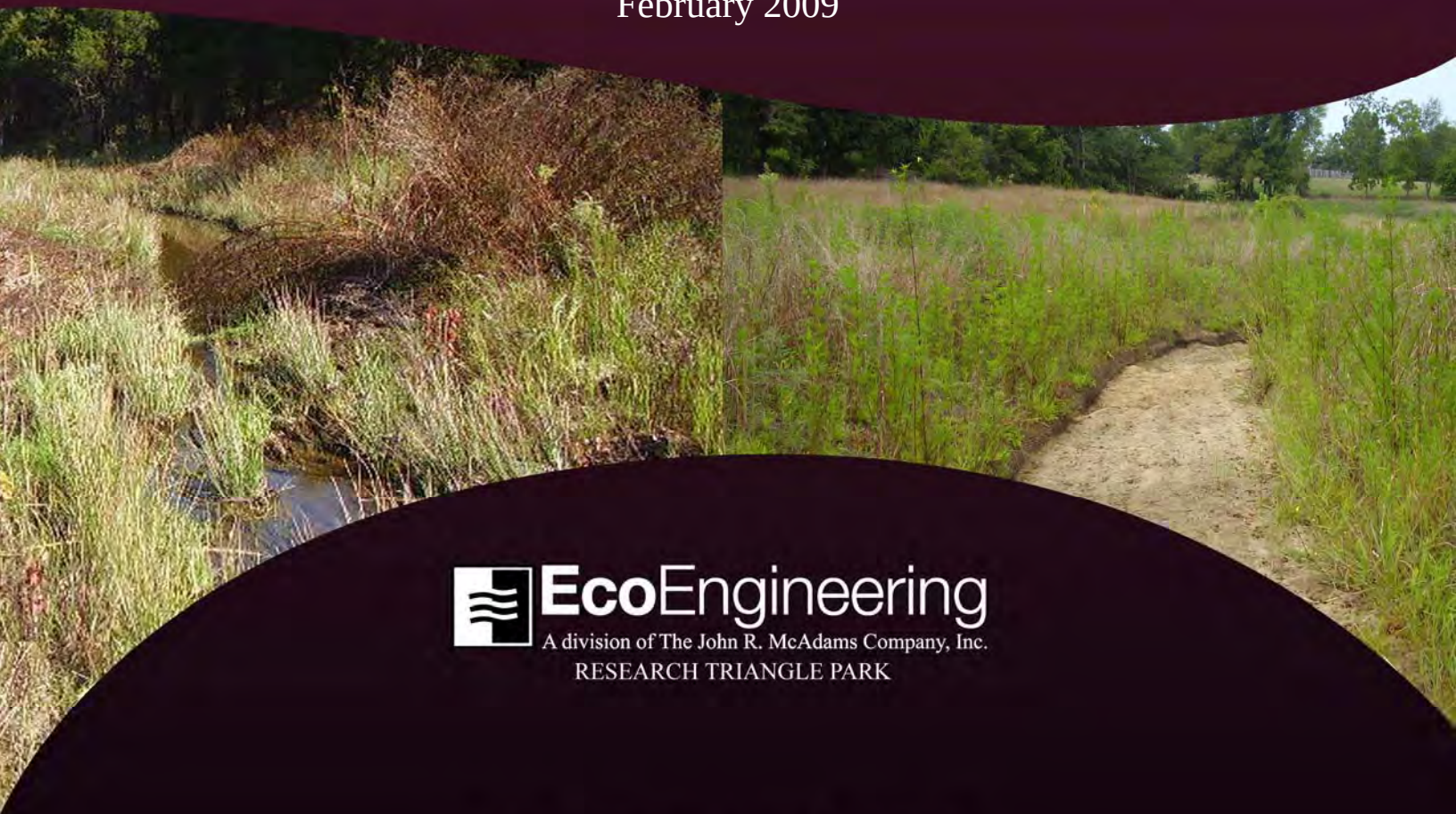

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Table of Contents

TABLES

Appendix A Vegetation Raw Data

Appendix B Geomorphologic Raw Data

1. Exhibit Table B.1. Stream Problem Areas
2. Representative Stream Problem Area Photos
3. Stream Photo Station Photos (see Appendix A Photo Stations)
4. Exhibit Table B.2. Visual Morphological Stability Assessment
5. Annual Overlays of Cross section Plots
6. Annual Overlays of Longitudinal Plots
7. Annual Overlays of pebble count frequency distribution plots

Appendix C Wetland Raw Data

Note: No wetlands are being monitored at this site.

Appendix D Integrated Problem Area Plan View

Executive Summary/Project Abstract

The UT to Sandy Creek Stream Restoration project was designed by Kimley-Horn and Associates, Inc. The UT to Sandy Creek Stream Mitigation Report was completed in March 2008 and the As-built Plan was completed on February 29, 2008. The project entails approximately 2,680 linear feet of stream of stream restoration.

The two primary concerns at UT to Sandy Creek are aggradation in the channel and low/absent flow conditions. Aggradation within the channel was observed in six (6) locations. The stream was dry during our initial site visit this year in August, although flow was observed during the survey work in September. A rainfall event occurred the night before survey work began, and subsequently, the stream flow observed on the first day decreased significantly each day over a three day period, to a point where the channel only contained a minimal amount of flow. Scour along the stream banks was evident along the right bank side from station 116+92 to 117+10. Man-made debris was also evident within the channel in three (3) locations.

Note: EcoEngineering has not received all of the requested information to complete all required sections of the report. Baseline 0-Year data for the longitudinal profile data and cross-sections in Microsoft Excel format must be provided to complete all required sections of the report. This data will be plotted and included in the Final draft.

No wetlands are being monitored for mitigation credits at this project site.

Various invasive species were observed at the site. Invasive species observed at the site include Chinese privet (Ligustrum sinense), silktree (Alibizia julibrissin), Japanese honeysuckle (Lonicera japonica) and Chinese lespedeza (Lespedeza cuneata). The extent of invasive species is depicted in the Integrated Project Problem Areas Plan View Appendix D. Noxious insect infestations (i.e. fire ants) are affecting the vegetation within the buffer. Thick vegetation in the channel was observed between stations 200+00 and 202+00.

No crest gages are installed at UT to Sandy Creek to document bankfull events. Wrack lines were evident during a site visit in October 2008 indicating at least one bankfull event has occurred.

Current stem counts were calculated using vegetation plot monitoring data. Interim density targets (stems/acre) are 320 at year 3 and 288 at year 4. Final stem count criteria is 260 trees per acre at the end of the five (5) year monitoring. As for monitored Year 1, UT Sandy had 6 plots encompassing 0.15 acres, containing 48 stems, which yielded a density of 320 trees per acre.

Several problem areas exist at this project site. The lack of surface water flow makes it difficult to make a determination regarding the stability of the stream system. As the project matures, morphological features should become more apparent and a stability determination can be made at that time. Invasive vegetation is prevalent throughout the riparian corridor and needs to be addressed. Man-made debris was observed in three locations and the road crossing is in a degraded state.

Current and future maintenance concerns at this site should be addressed to protect the integrity of the project. Currently a crest gauge needs at be installed as soon as possible, all exotic and invasive vegetation needs to be treated to prevent it from spreading throughout the buffer, and all man-made debris should be removed from the channel. During subsequent monitoring years, noxious insect populations should be controlled if their presence begins to prevent desired establishment of riparian vegetation, and bank scour (STA 116+92) should be addressed if conditions do not improve. Future annual maintenance should include periodic invasive vegetation control. The in-channel vegetation between stations 200+00 and 202+00 should only be removed if lateral and/or vertical instability persists at Monitoring Year 5.

1.0 Project Background

1.1 Project Objectives

Excerpt from the UT to Sandy Creek Stream Draft Mitigation Report (Kimley-Horn, 2008):
"The goal of the restoration project is to improve the water quality and biological habitat of the site's streams, wetlands, and riparian buffers through the following:

-Restoration (pattern, dimension, and profile) of unstable streams using natural channel design techniques
-Re-establishment of riparian buffers"

1.2 Project Structure, Restoration Type, and Approach

Excerpt from the UT to Sandy Creek Stream Draft Mitigation Report (Kimley-Horn, 2008):
"The design of the channel reaches employed a Priority I restoration approach. Morphological data from the reference reach, piedmont rural regional curves, regime equations, and the existing channel morphology were used in the design, and stable reaches of the existing channel were considered. These parameters were used in determining the proper dimension, pattern, and profile of the proposed channels.

The restored channels have banks constructed at a 3:1 slope to ensure stability until deep rooted vegetation can become established. To ensure proper bed width using these slopes, the channels for this project are Rosgen C type channels. Increasing sinuosity on all channels for restoration will decrease average stream slopes and will provide the proper pool and riffle sequencing found in natural reference stream systems. Bed material samples were taken, and sediment transport calculations were performed to ensure that the proper profile was designed for the channel dimensions.

Prior to planting the riparian buffer, efforts will be made to eradicate fescue. These efforts should include herbicide use during the spring and a follow-up spraying in early fall to eliminate any fescue not killed in the spring.

Vegetation planted within the floodplain and along the stream banks provide stability to the stream channels by reducing scour and runoff erosion. Pioneer species were planted along the stream bank to provide immediate bank stabilization and create an environment suitable for latter species common in mature riparian habitats. Live stakes and bare roots were planted around structure installations and the outside of meander bends to provide an area of high density root mass. Trees and shrubs were planted using live stakes, bare root, or container stock along the tops of the channel banks."

1.3 Location and Setting

Excerpt from the UT to Sandy Creek Stream Draft Mitigation Report (Kimley-Horn, 2008):
"The Unnamed Tributary to Sandy Creek Stream Restoration project falls within the Williams (Williams Farm) and Henry (Rising Meadows Farm) Properties in Randolph County on Old Liberty Road, approximately 5.5 miles west of Liberty, North Carolina. The site streams lie within the USGS hydrologic unit **03030003**020010 in the Cape Fear River Basin. The site is defined by the protective conservation easement surrounding the stream and riparian buffers covers approximately 10.2 acres.

Prior to restoration, the 28-acre Henry property contained the upper 1,000 feet of an unnamed tributary and two wetland seeps. The 20-acre Williams property contained the lower 870 feet of this unnamed tributary, 290 feet of another small unnamed tributary that flowed from a pond, and one wetland seep. The total existing length of the streams prior to restoration was 2,160 feet. The project watershed drains approximately 4.2 square miles of mostly agricultural and forest land of the southern piedmont.

Pasture land surrounded the project reach and the stream banks lacked strong rooted vegetation (e.g., woody or deep-rooted herbaceous vegetation). For most of the riparian buffer was dominated by pasture grasses with isolated specimens of hardwoods. In areas where continuous woody buffers exist, the buffers extend only 5 to 10 feet beyond the top of the left and right banks. Riparian zone woody vegetation included Chinese privet (*Ligustrum sinense*), sycamore (*Platanus occidentalis*), hackberry (*Celtis* spp.) and black walnut (*Juglans nigra*). Due to the lack of bank protection and denuded watershed, the stream channel incised (bank height ratios of 1.2-1.6) and entrenched (entrenchment ratios of 2.4-15.9). In this condition and with regular impacts due to cattle traffic, bank erosion had accelerated and the variety of bed features diminished. The BEHI scores for the reaches ranged from moderately to highly unstable. With active cattle grazing in the area, the channel would have continued to receive impacts."

1.4 Project History and Background

The UT to Sandy Creek Stream Restoration project was designed by Kimley-Horn and Associates, Inc. The UT to Sandy Creek Stream Mitigation Report was completed in March 2008 and the As-built Plan was completed on February 29, 2008.

Excerpt from the UT to Sandy Creek Stream Draft Mitigation Report (Kimley-Horn, 2008): "This project resulted in the restoration of three impaired stream channels' dimension, pattern, and profile for approximately 2,680 linear feet of stream. Reconnecting the channel with its abandoned floodplain will improve stability by increasing the frequency of over-bank flooding, increasing hydrology to the riparian wetland seeps, and reducing shear stress. With the restoration, water quality should be improved due to a decrease in nutrients and turbidity, as well as a more moderate water temperature. Biological and chemical oxygen demand should be reduced through filtering in the riparian buffer and riverine wetlands. Potential habitats have been added through the creation of bed features, stable undercut stream banks, and re-establishment of a riparian vegetative community."

Exhibit Table I. Project Restoration Components
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601

Project Segment or Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Reach 1	1,000	R	P1	1,410	1	1,410	100+00 - 114+00	
Reach II	870	R	P1	886	1	886	114+00 - 122+97.27	
Reach III	290	R	P1	384	1	384	200+00 - 203+84.76	Pond Tributary

Mitigation Unit Summations

Stream (lf)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)	Buffer (Ac)	Comment
2,680	0	0	0	10.2	

R= Restoration EII= Enhancement II P1= Priority I P3= Priority III
EI= Enhancement S= Stabilization P2= Priority II SS=Stream Bank Stabilization

Exhibit Table II. Project Activity and Reporting History
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	Not provided	Jan-05
Final Design – 90%	Not provided	Not provided
Construction	Not provided	Not provided
Temporary S&E mix applied to entire project area	Not provided	Not provided
Permanent seed mix applied to reach/segments 1 & 2	Not provided	Not provided
Containerized and B&B plantings for reach/segments 1 & 2	Not provided	Not provided
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Not provided	Mar-08
Year 1 Monitoring	Oct-08	Nov-08
Year 2 Monitoring	-----	-----
Structural maintenance (bench expansion, vane adjustment) Reach 1	-----	-----
Year 3	-----	-----
Supplemental planting of containerized material reach/segment 1	-----	-----
Year 4 Monitoring	-----	-----
Year 5 Monitoring	-----	-----
Year 5+ Monitoring	-----	-----

Bolded items represent those events or deliverables that are variable. Non-bolded items represent events that are standard components over the course of a typical project.

Exhibit Table III. Project Contacts Table UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601	
Designer Primary project design POC	Kimley-Horn and Associates, Inc. P.O Box 33068, Raleigh, North Carolina 27636 POC name and phone 919-677-2050
Construction Contractor Construction contractor POC	Not provided
Planting Contractor Planting contractor POC	Not provided
Seeding Contractor Planting contractor POC	Not provided
Seed Mix Sources	Not provided
Nursery Stock Suppliers	Not provided
Monitoring Performers	EcoEngineering - A Division of The John R. McAdams Co. 2905 Meridian Parkway, Durham, NC 27713
Stream Monitoring POC Jim Halley	919-287-4262
Vegetation Monitoring POC Jim Halley	919-287-4262
Wetland Monitoring POC NA	NA

Exhibit Table IV. Project Background Table UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601	
Project County	Randolph County
Drainage Area	4.2 square miles
Drainage impervious cover estimate (%) For example	Estimated at 1%
Stream Order	1st for UT to Sandy Creek
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-built	C
Cowardin Classification	R3UBH
Dominant soil types	Chewacla loam, Vance
Reference site ID	Reference Reach Tributary to Sandy Creek
USGS HUC for Project and Reference	3030003020010
NCDWQ Sub-basin for Project and Reference	03-06-09
NCDWQ classification for Project and Reference	WSIII
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	NA
% of project easement fenced	100%

1.5 Monitoring Plan View

See **Appendix D** for Stream Restoration Project – Year One Monitoring Plan View.

2.0 Project Condition and Monitoring Results

2.1 Vegetation Assessment

Vegetation monitoring plot stem counts and photos are located in **Appendix A**.

2.1.1 Vegetative Problem Areas

Vegetative problem areas can be grouped into three categories: invasive species encroachment, noxious insect populations, and thick vegetation in channel. Of the three categories, the invasive species encroachment and noxious insect population categories are of high concern.

Within the upstream areas of the pond tributary (Stations 200+00 to 202+00), the stream channel contains thick vegetation which maybe due to over seeding and/or low flow or absent flow conditions within the channel. Channel morphology has been influenced by the thick vegetation causing flow patterns within the channel to be altered.

There are areas in which invasive populations have encroached into project area. Areas of Chinese privet (*Ligustrum sinense*), silktree (*Alibizia julibrissin*), and Japanese honeysuckle (*Lonicera japonica*) were noted shown on Integrated Problem Area Plan View in **Appendix D**. Additionally, there are areas of Chinese lespedeza (*Lespedeza cuneata*) located around Vegetation Plots 1, 2, and 3.

2.1.2 Vegetative Problem Area Plan View

All vegetative problem areas discussed above are shown on Stream Restoration Project – Year One Monitoring Plan View located in **Appendix D**.

2.2 Stream Assessment

2.2.1 Procedural Items

2.2.1.1 Morphometric Criteria

Dimension and profile were sampled per the 2003 Stream Mitigation Guidelines (USACE, 2003) as follows:

2.2.1.1.1 Dimension

See **Appendix B** for cross-section information.

2.2.1.1.2 Profile

See **Appendix B** for longitudinal profile information.

2.2.1.2 Hydrologic Criteria

No crest gages are installed at Naked Creek to document bankfull events. Wrack lines were evident during a site visit in October 2008 indicating at least one bankfull event has occurred.

Exhibit Table V. Verification of Bankfull Events UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
October 3, 2008	October 1, 2008	photo	Photo 79, **Appendix A** Photo Stations

Note: Crest gages have not been installed at the site.

2.2.1.2 Bank Stability Assessments

This is the first year of monitoring; and therefore, BEHI and NBS assessments were not performed. As required by EEP, BEHI and NBS assessments will be performed during the year five monitoring period.

Exhibit Table VI. BEHI and Sediment Export Estimates UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601															
Time Point	**Segment/ Reach**	**Linear Footage or Acreage**	**Extreme**		**Very High**		**High**		**Moderate**		**Low**		**Very Low**		**Sediment Export**
			ft	**%**	**ft**	**%**	**ft**	**%**	**ft**	**%**	**ft**	**%**	**ft**	**%**	**Ton/y**

Note: First year of monitoring does not require BEHI and NBS assessments. BEHI and NBS assessments will be conducted during year five monitoring.

2.2.2 Problem Areas Plan View

See **Appendix D** for Stream Restoration Project – Year One Monitoring Plan View.

2.2.3 Problem Areas Summary

See Exhibit Table B.1 in **Appendix B** for the Stream Problem Areas table.

2.2.4 Stream Problem Area Photographs

See representative stream problem area photographs located in **Appendix B**.

2.2.5 Fixed Station Photos

Stream Photo Station photographs are located in **Appendix A**.

2.2.6 Stability Assessment

The following is the categorical Stream Feature Visual Stability Assessment Table (Exhibit Table VII).

Exhibit Table VII. Categorical Stream Feature Visual Stability Assessment UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601 Unnamed Tributary to Sandy Creek: 2,680 Linear Feet						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	78%					
B. Pools	89%					
C. Thalweg	100%					
D. Meanders	95%					
E. Bed General	100%					
F. Bank Condition	99%					
G. Vanes/J-Hooks etc.	100%					
H. Wads and Boulders	100%					

2.2.7 Quantitative Measures Summary

The following are the Baseline Morphology and Hydraulic Summary (Exhibit Table VIII) and Morphology and Hydraulic Monitoring Summary (Exhibit Table IX) tables.

Exhibit Table VIII. Baseline Morphology and Hydraulic Summary
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,355 Linear Feet

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)															17.6			
Floodprone Width (ft)															80			
BF Cross Sectional Area (ft2)															20.7			
BF Mean Depth (ft)															1.2			
BF Max Depth															1.6			
Width/Depth Ratio															14.9			
Entrenchment Ratio															4.5			
Bank Height Ratio															1			
Wetted Perimeter (ft)													Not Provided					
Hydraulic radius (ft)													Not Provided					
Pattern																		
Channel Beltwidth (ft)															58			
Radius of Curvature (ft)															52.8			
Meander Wavelength (ft)													158	246	194			
Meander Width ratio															3.3			
Profile																		
Riffle length (ft)													Not Provided					
Riffle slope (ft/ft)															0.0041			
Pool length (ft)													Not Provided					
Pool spacing (ft)															111			
Substrate																		
d50 (mm)													Not Provided					
d84 (mm)													Not Provided					
Additional Reach Parameters																		
Valley Length (ft)															2102			
Channel Length (ft)															2355			
Sinuosity															1.3			
Water Surface Slope (ft/ft)															0.0045			
BF slope (ft/ft)															0.0045			
Rosgen Classification															C4			
*Habitat Index																		
*Macrobenthos																		

*Inclusion will be project specific and determined by As-built monitoring plan/success criteria

Exhibit Table VIII. Baseline Morphology and Hydraulic Summary
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek - Tributary: 387 Linear Feet

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)															7.3			
Floodprone Width (ft)															180			
BF Cross Sectional Area (ft2)															3.5			
BF Mean Depth (ft)															0.5			
BF Max Depth															0.7			
Width/Depth Ratio															15.2			
Entrenchment Ratio															24.7			
Bank Height Ratio															1			
Wetted Perimeter (ft)													Not Provided					
Hydraulic radius (ft)													Not Provided					
Pattern																		
Channel Beltwidth (ft)															24			
Radius of Curvature (ft)															21.9			
Meander Wavelength (ft)													66	102	80			
Meander Width ratio															3.3			
Profile																		
Riffle length (ft)													Not Provided					
Riffle slope (ft/ft)															0.0165			
Pool length (ft)													Not Provided					
Pool spacing (ft)															46			
Substrate																		
d50 (mm)													Not Provided					
d84 (mm)													Not Provided					
Additional Reach Parameters																		
Valley Length (ft)															336			
Channel Length (ft)															387			
Sinuosity															1.3			
Water Surface Slope (ft/ft)															0.0124			
BF slope (ft/ft)															0.0124			
Rosgen Classification															C4			
*Habitat Index																		
*Macrobenthos																		

*Inclusion will be project specific and determined by As-built monitoring plan/success criteria

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,680 Linear Feet

Parameter	Cross Section 1 Riffle						Cross Section 2 Pool						Cross Section 3 Riffle						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	41.0						25.6						15.7						30.1					
Floodprone Width (ft)	100						100						100						100					
BF Cross Sectional Area (ft2)	31.8						45.6						20.2						50.3					
BF Mean Depth (ft)	0.8						1.8						1.3						1.7					
BF Max Depth (ft)	2.0						4.1						2.4						4.0					
Width/Depth Ratio	52.8						14.4						12.2						18.0					
Entrenchment Ratio	2.68						N/A						6.4						N/A					
Bank Height Ratio	1.0						1.0						1.0						1.0					
Wetted Perimeter (ft)	41.4						29.5						16.8						31.6					
Hydraulic radius (ft)	0.8						1.5						1.2						1.6					
Substrate																								
d50 (mm)	15.6						N/A						0.1						N/A					
d84 (mm)	44						N/A						0.0						N/A					

Parameter	Trib - Cross Section 5 Riffle						Trib - Cross Section 6 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	24.5						13.6					
Floodprone Width (ft)	100						100					
BF Cross Sectional Area (ft2)	11.9						12.6					
BF Mean Depth (ft)	0.5						0.9					
BF Max Depth (ft)	1.3						2.0					
Width/Depth Ratio	50.8						14.6					
Entrenchment Ratio	4.1						7.4					
Bank Height Ratio	1.0						1.0					
Wetted Perimeter (ft)	24.8						14.2					
Hydraulic radius (ft)	0.5						0.9					
Substrate												
d50 (mm)	0.1						N/A					
d84 (mm)	80						N/A					

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,680 Linear Feet

Unnamed Tributary to Sandy Creek																		
Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+ (2013)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	22.8	79.2	50.9															
Radius of Curvature (ft)	18.8	74.6	37.9															
Meander Wavelength (ft)	127.1	285.8	187.4															
Meander Width ratio	1.267	4.40	2.828															
Profile																		
Riffle length (ft)	6.54	74.34	19.17															
Riffle slope (ft/ft)	0.00	0.062	0.008															
Pool length (ft)	7	57	25															
Pool spacing (ft)	7	175	71															
Additional Reach Parameters																		
Valley Length (ft)	2102																	
Channel Length (ft)	2355.7																	
Sinuosity	1.12																	
Water Surface Slope (ft/ft)	0.010																	
BF slope (ft/ft)	0.007																	
Rosgen Classification	C4																	
Habitat Index*																		
Macrobenthos*																		

Exhibit Table IX. Morphology and Hydraulic Monitoring Summary
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,680 Linear Feet

UT to Sandy Creek - Tributary																		
Parameter	MY-01 (2008)			MY-02 (2009)			MY-03 (2010)			MY-04 (2011)			MY-05 (2012)			MY+ (2013)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	22.8	79.2	50.9															
Radius of Curvature (ft)	18.8	74.6	37.9															
Meander Wavelength (ft)	127.1	285.8	187.4															
Meander Width ratio	1.267	4.40	2.828															
Profile																		
Riffle length (ft)	7.95	34.09	23.51															
Riffle slope (ft/ft)	0.00	0.036	0.009															
Pool length (ft)	4	20	8															
Pool spacing (ft)	32	77	52															
Additional Reach Parameters																		
Valley Length (ft)	336																	
Channel Length (ft)	387																	
Sinuosity	1.15																	
Water Surface Slope (ft/ft)	0.060																	
BF slope (ft/ft)	0.019																	
Rosgen Classification	C4																	
Habitat Index*																		
Macrobenthos*																		

2.3 Wetland Assessment

2.3.1 Problem Areas Plan View

The UT to Sandy Creek Stream Restoration project does not have wetland areas; therefore, a wetland assessment was not performed.

2.3.2 Wetland Criteria Attainment

The UT to Sandy Creek Stream Restoration project does not have wetland areas; therefore, a wetland assessment was not performed.

Exhibit Table X. Wetland Criteria Attainment						
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601						
Tract	**Well ID**	**Well Hydrology Threshold Met?**	**Tract Mean**	**Vegetation Plot ID**	**Vegetation Survival Threshold Met?**	**Tract Mean**

*There are no wetland areas present at the UT to Sandy Creek Stream Restoration site.

3.0 Methodology Section

All monitoring methodologies follow the most current templates and guidelines provided by EEP (EEP, 2006). Photographs were taken at high resolution using an Olympus FE-115 5.0 megapixel digital camera. GPS location information was collected using a Trimble Geo XT handheld mapping grade GPS unit. Stream and vegetation problem areas were noted in the field on As-Built Plan Sheets.

The methods used to generate the data in this report are standard fluvial geomorphology techniques as described in *Applied River Morphology* (Rosgen, 1996) and related publications from US Forest Service and the interagency Stream Mitigation Guidelines (USACE, 2003).

Vegetation monitoring methods followed the 2007, Version 4.1 CVS-EEP Protocol for Recording Vegetation (Lee et. al., 2007). Vegetation plot photographs were collected for each vegetation plot. Vegetation monitoring plots were re-marked in the field by replacing all old flagging with new flagging. Monitoring taxonomy follows *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley, 2007). Stem height was measured with a folding one-meter rule. Diameter at breast height and decimeter height were measured with calipers.

References:

Ecosystem Enhancement Program (EEP), 2006. Monitoring Report Guidelines.

Kimley-Horn and Associates, Inc., 2008. UT to Sandy Creek Stream Mitigation Report. Submitted to NCDENR-EEP, March 2008.

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2007. CVS-EEP Protocol for Recording Vegetation, Version 4.1 (http://cvs.bio.unc.edu/methods.htm)

Rosgen, D.L. 1996. Applied Morphology. Wildland Hydrology, Pagosa Springs, CO.

US Army Corps of Engineers (USACE), 2003. April 2003 Stream Mitigation Guidelines.

US Army Corps of Engineers (USACE), 2005. Information Regarding Stream Restoration In The Outer Coastal Plain of North Carolina. US Army Corps of Engineers, Wilmington District, Regulatory Division and North Carolina Department of Environment and Natural Resources, Division of Water Quality, December 1, 2005.

Weakley, A. S., 2008. Flora of the Carolinas, Virginia, Georgia, northern Florida, and surrounding areas. University of North Carolina Herbarium (NCU), North Carolina Botanical Garden, University of North Carolina at Chapel Hill, working Draft as of April 7, 2008.

APPENDIX A

Table 1. Vegetation Metadata UT to Sandy Creek Restoration Project/EEP Project ID: 040611601	
Report Prepared By	George Buchholz
Date Prepared	10/13/2008 16:14
database name	EcoEngineering-2008-C.mdb
database location	X:\Projects\EEP\EEP-08030 (UT to Sandy Creek)\Storm
computer name	BUCHHOLZ

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	40611601
project Name	UT to Sandy
Description	
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	6

Table 2. Vegetation Vigor by Species UT to Sandy Creek Restoration Project/EEP Project ID: 040611601								
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Betula nigra		3					
	Celtis laevigata				2			
	Cornus amomum		1	5	8			
	Fraxinus pennsylvanica		1	10	3			
	Juglans nigra		1					
	Quercus phellos			1				
	Viburnum dentatum		1	6				
	Hamamelis virginiana		2	1				
	Lindera benzoin		1					
	Prunus serotina		1					
	Acer rubrum		1					
	Unknown					8		
TOT:	**12**		**12**	**23**	**13**	**8**		

Table 3. Vegetation Damage by Species
UT to Sandy Creek Restoration Project/EEP Project ID: 040611601

	Species	All Damage Categories	(no damage)	Diseased	Insects	Unknown	Vine Strangulation	(other damage)
	Acer rubrum	1	1					
	Betula nigra	3	3					
	Celtis laevigata	2				2		
	Cornus amomum	14	1			7	1	5
	Fraxinus pennsylvanica	14	1			8	1	4
	Hamamelis virginiana	3	2	1				
	Juglans nigra	1	1					
	Lindera benzoin	1	1					
	Prunus serotina	1	1					
	Quercus phellos	1				1		
	Unknown	8						8
	Viburnum dentatum	7	1		3	2		1
TOT:	**12**	**56**	**12**	**1**	**3**	**20**	**2**	**18**

Table 4. Vegetation Damage by Plot

UT to Sandy Creek Restoration Project/EEP Project ID: 040611601

	plot	All Damage Categories	(no damage)	Diseased	Insects	Unknown	Vine Strangulation	(other damage)
	070715101-01-VP1-year:1	6			1	3		2
	070715101-01-VP2-year:1	10	1	1	1	4		3
	070715101-01-VP3-year:1	10	2			8		
	070715101-01-VP4-year:1	16	1			3	2	10
	070715101-01-VP5-year:1	5	4					1
	070715101-01-VP6-year:1	9	4		1	2		2
TOT:	**6**	**56**	**12**	**1**	**3**	**20**	**2**	**18**

Table 5. Stem Count by Plot and Species
UT to Sandy Creek Restoration Project/EEP Project ID: 040611601

	Species	Total Planted Stems	# plots	avg# stems	plot 070715101-01-VP1-year:1	plot 070715101-01-VP2-year:1	plot 070715101-01-VP3-year:1	plot 070715101-01-VP4-year:1	plot 070715101-01-VP5-year:1	plot 070715101-01-VP6-year:1
	Acer rubrum	1	1	1					1	
	Betula nigra	3	1	3						3
	Celtis laevigata	2	1	2	2					
	Cornus amomum	14	3	4.67		1	5	8		
	Fraxinus pennsylvanica	14	4	3.5	2	3	4	5		
	Hamamelis virginiana	3	2	1.5		2			1	
	Juglans nigra	1	1	1						1
	Lindera benzoin	1	1	1			1			
	Prunus serotina	1	1	1					1	
	Quercus phellos	1	1	1		1				
	Viburnum dentatum	7	4	1.75	1	1			1	4
TOT:	**11**	**48**	**11**		**5**	**8**	**10**	**13**	**4**	**8**

PHOTOGRAPH 1: RIP-RAP. HEAD OF UT-1.

PHOTOGRAPH 2: CROSS VANE. STA: 100+12.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 3: CROSS VANE. STA: 100+73.

PHOTOGRAPH 4: CONSTRUCTED RIFFLE. STA: 101+09.

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PHOTOGRAPH 5: CROSS VANE. STA: 101+40.

PHOTOGRAPH 6: CONSTRUCTED RIFFLE. STA: 102+25.

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PHOTOGRAPH 7: CROSS VANE. STA: 102+85.

PHOTOGRAPH 8: CONSTRUCTED RIFFLE. STA: 103+15.

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PHOTOGRAPH 9: RIP-RAP FOR WETLAND AREA.

PHOTOGRAPH 10: CONSTRUCTED RIFFLE. STA: 103+88.

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PHOTOGRAPH 11: CROSSING. STA: 104+23.

PHOTOGRAPH 12: CROSS VANE. STA: 104+75.

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PHOTOGRAPH 13: CROSS VANE. STA: 105+62.

PHOTOGRAPH 14: "A" VANE. STA: 106+60.

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FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 15: RIP-RAP.

PHOTOGRAPH 16: CROSS VANE. STA: 107+49.

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PHOTOGRAPH 17: CROSS VANE. STA: 108+11.

PHOTOGRAPH 18: CONSTRUCTED RIFFLE. STA: 108+77.

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PHOTOGRAPH 19: "A" VANE. STA: 109+14.

PHOTOGRAPH 20: CONSTRUCTED RIFFLE. STA:109+58.

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PHOTOGRAPH 21: CROSS VANE. STA: 110+26.

PHOTOGRAPH 22: CONSTRUCTED RIFFLE. STA: 110+58.

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PHOTOGRAPH 23: CROSSING. STA: 111+32.

PHOTOGRAPH 24: CROSS VANE. STA: 111+66.

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PHOTOGRAPH 25: CONSTRUCTED RIFFLE. STA: 112+15.

PHOTOGRAPH 26: CROSS VANE. STA: 112+70.

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PHOTOGRAPH 27: "A" VANE. STA: 113+80.

PHOTOGRAPH 28: CROSS VANE. STA: 115+15.

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PHOTOGRAPH 29: "A" VANE. STA: 116+29.

PHOTORGAPH 30: "A" VANE. STA: 117+58.

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PHOTOGRAPH 31: "A" VANE. STA: 118+46.

PHOTOGRAPH 32: CROSS VANE. STA: 119+07.

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PHOTOGRAPH 33: CONSTRUCTED RIFFLE. STA: 120+25.

PHOTOGRAPH 34: RIP-RAP. WETLAND DRAINAGE.

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PHOTOGRAPH 35: RIP-RAP. WELTAND DRAINAGE.

PHOTOGRAPH 36: CROSS VANE. STA: 122+00.

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FILENAME:	EEP08030X.DWG
SCALE:	NTS
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PHOTOGRAPH 37: RIP-RAP. HEAD OF UT-2.

PHOTOGRAPH 38: CROSS VANE. STA: 200+57.

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PHOTOGRAPH 39: CROSS VANE. STA: 201+16.

PHOTOGRAPH 40: CROSS VANE. STA: 202+64.

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SCALE:	NTS
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PHOTOGRAPH 41: CROSS VANE. STA: 203+15.

PHOTOGRAPH 42: CROSS VANE. STA: 203+58.

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FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 43: CROSS SECTION I LOOKING UPSTREAM.

PHOTOGRAPH 44: CROSS SECTION I LOOKING DOWNSTREAM.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 45: CROSS SECTION I LOOKING AT THE LEFT BANK.

PHOTOGRAPH 46: CROSS SECTION I LOOKING AT THE RIGHT BANK.

PROJECT NO.	EEP-08030
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SCALE:	NTS
DATE:	080-15-08

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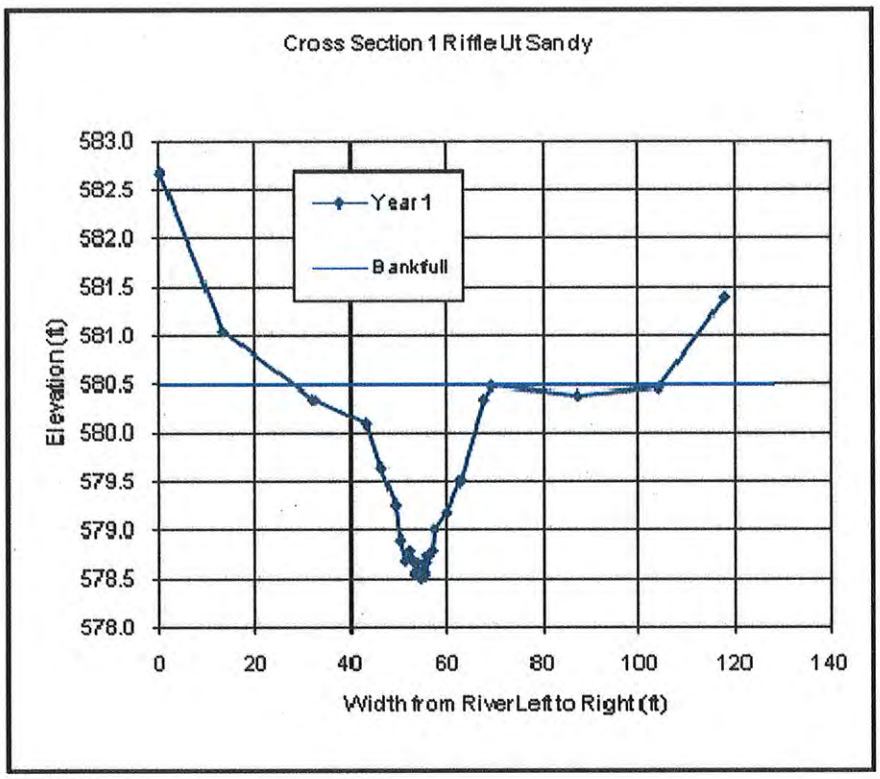
PHOTOGRAPH 47: CROSS SECTION 1 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 1

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PHOTOGRAPH 48: CROSS SECETION 2 LOOKING UPSTREAM.

PHOTOGRAPH 49: CROSS SECTION 2 LOOKING DOWNSTREAM.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
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PHOTOGRAPH 50: CROSS SECTION 2 LOOKING AT THE LEFT BANK.

PHOTOGRAPH 51. CROSS SECTION 2 LOOKING AT THE RIGHT BANK.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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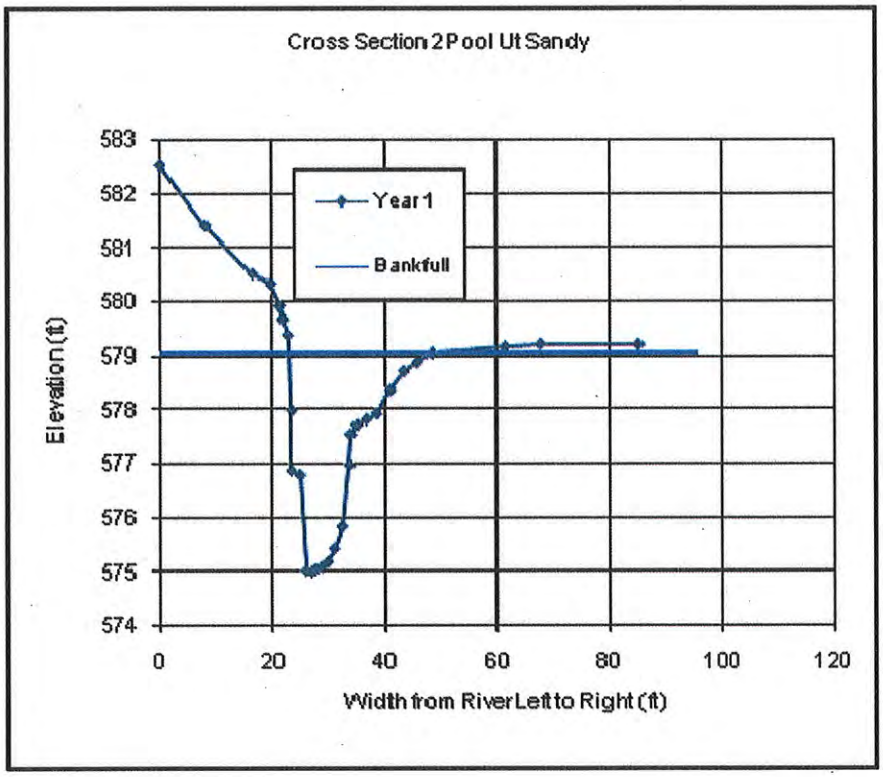
PHOTOGRAPH 52: CROSS SECTION 2 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 2

PROJECT NO.	EEP-08030
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PHOTOGRAPH 53: CROSS SEECTION 3 LOOKING UPSTREAM.

PHOTOGRAPH 54: CROSS SECTION 3 LOOKING DOWNSTREAM.

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DATE:	080-15-08

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PHOTOGRAPH 55: CROSS SECTION 3 LOOKING AT THE BANK.

PHOTOGRAPH 56: CROSS SECTION 3 LOOKING AT THE RIGHT BANK.

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PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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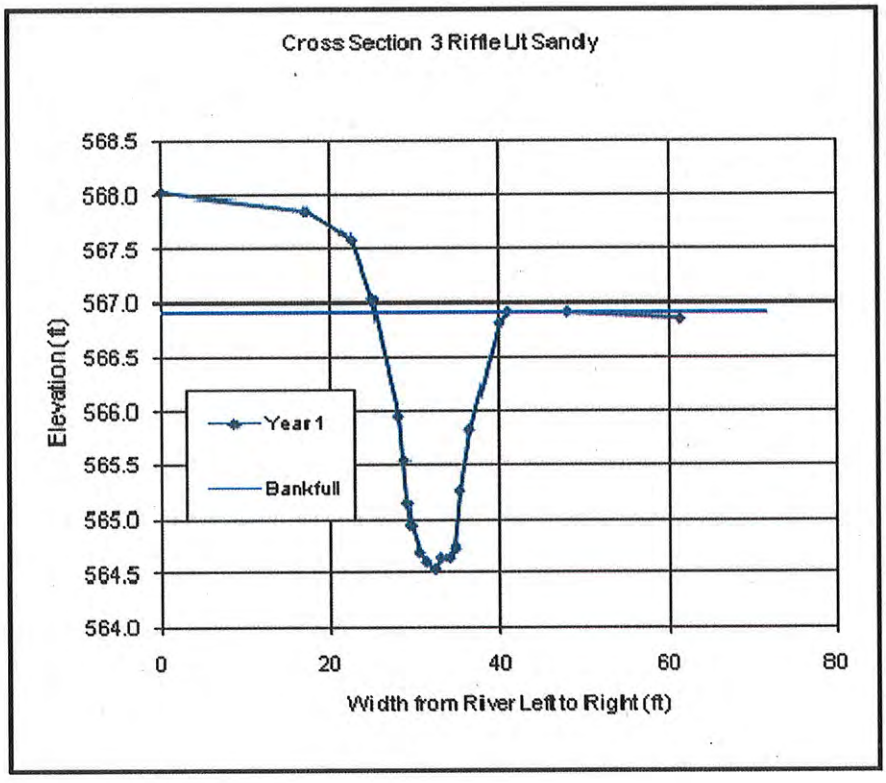
PHOTOGRAPH 57: CROSS SECTION 3 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 3

PROJECT NO.	EEP-08030
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SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 58: CROSS SECTION 4 LOOKING UPSTREAM.

PHOTOGRAPH 59: CROSS SECTION 4 LOOKING DOWNSTREAM.

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SCALE:	NTS
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PHOTOGRAPH 60: CROSS SECTION 4 LOOKING AT THE LEFT BANK.

PHOTOGRAPH 61: CROSS SECTION 4 LOOKING AT THE RIGHT BANK.

PROJECT NO.	EEP-08030
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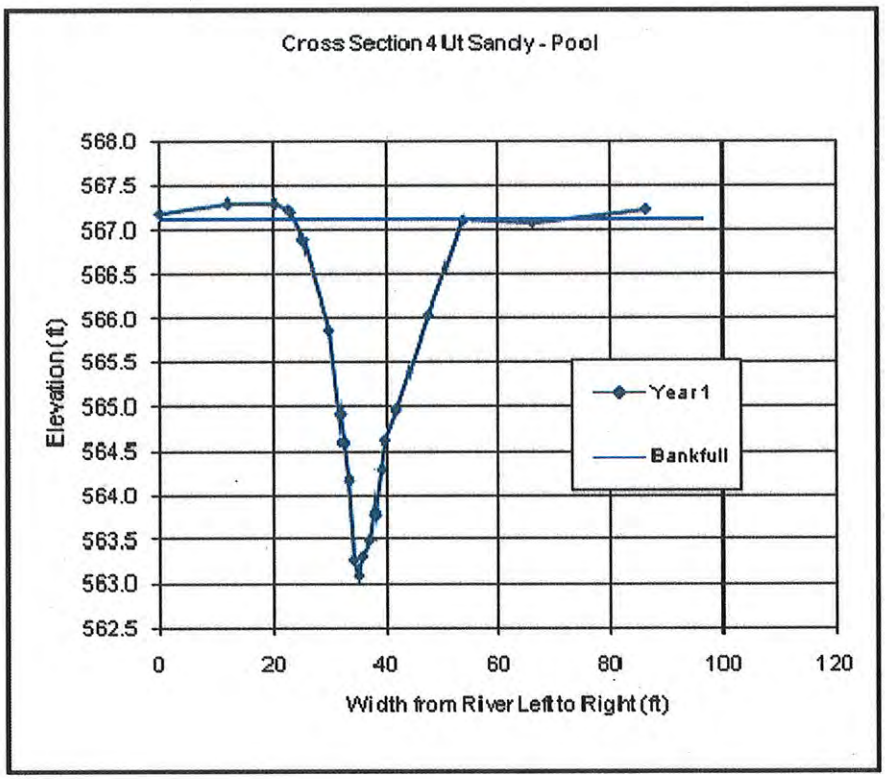
PHOTOGRAPH 62: CROSS SECTION 4 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 4

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 63: CROSS SECTION 5 LOOKING UPSTREAM.

PHOTOGRAPH 64: CROSS SECTION 5 LOOKING DOWNSTREAM.

McADAMS	PROJECT NO. EEP-08030 FILENAME: EEP08030X.DWG SCALE: NTS DATE: 080-15-08	Ecosystem Enhancement PROGRAM	UT to SANDY CREEK RESTORATION MONITORING PHOTOGRAPHS RANDOLPH COUNTY, NC	EcoEngineering A division of The John R. McAdams Company, Inc. RESEARCH TRIANGLE PARK, NC P.O. BOX 14005 ZIP 27709-4005 (919) 361-5000

PHOTOGRAPH 65: CROSS SECTION 5 LOOKING AT THE LEFT BANK.

PHOTOGRAPH 66: CROSS SECTION 5 LOOKING AT THE RIGHT BANK.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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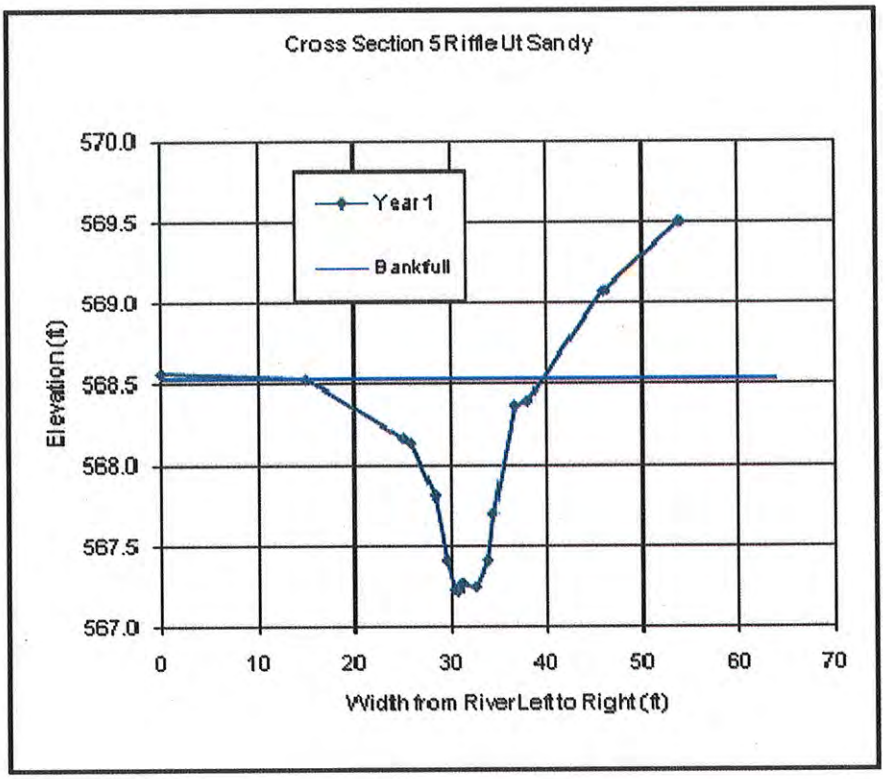
PHOTOGRAPH 67: CROSS SECTION 5 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 5

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 68. CROSS SECTION 6 LOOKING UPSTREAM.

PHOTOGRAPH 69: CROSS SECTION 6 LOOKING DOWNSTREAM.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 70: CROSS SECTION 6 LOOKING AT THE LEFT BANK.

PHOTOGRAPH 71: CROSS SECTION 6 LOOKING AT THE RIGHT BANK.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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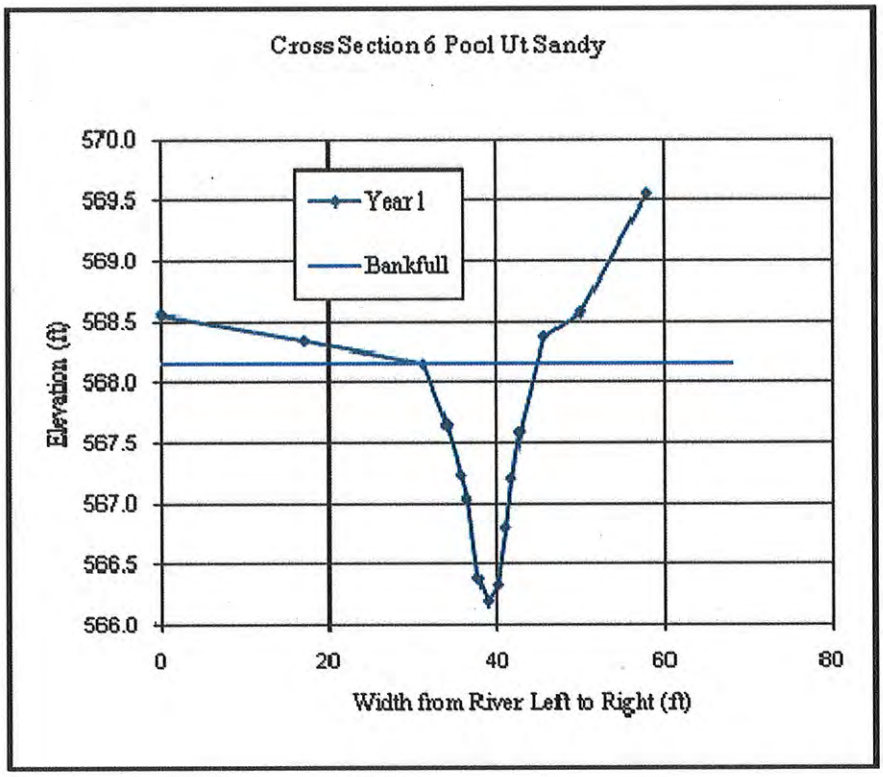
PHOTOGRAPH 72: CROSS SECTION 6 LOOKING AT THE SUBSTRATE COMPOSITION.



CROSS SECTION 6

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 73: VEGETATION PLOT 1.

PHOTOGRAPH 74: VEGETATION PLOT 2.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 75: VEGETATION PLOT 3.

PHOTOGRAPH 76: VEGETATION PLOT 4.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 77: VEGETATION PLOT 5.

PHOTOGRAPH 78: VEGETATION PLOT 6.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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PHOTOGRAPH 79: WRACK LINES EVIDENT INDICATING BANKFULL EVENT WHICH OCCURRED ON OCTOBER 1, 2008.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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Table 6. Vegetative Problem Areas			
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Invasive/Exotic Populations	See Plan View	*Ligustrum sinense, Albizia julibrissin, Lonicera japoinca* encroachment	VPA1, VPA2, VPA3
	201+50	*Typha latifolia* encroachment	VPA4
Noxious Insect Populations	See Plan View	Fire ant encroachment	VPA5
Thick Vegetation in Channel	200+00 - 202+00, 118+25	Thick vegetation in channel may be due to over seeding and/or low flow or absent flow conditions	VPA6 & VPA7

VEGETATION PROBLEM AREA 1: LIGUSTRUM SINENSE ENCROACHMENT.

VEGETATION PROBLEM AREA 2: ALBIZIA JULIBRISSIN ENCROACHMENT.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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VEGETATION PROBLEM AREA 3: LONICERA JAPONICA ENCROACHMENT.

VEGETATION PROBLEM AREA 4: TYPHA LATIFOLIA ENCROACHMENT AT STATION 201+50.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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VEGETATION PROBLEM AREA 5. FIRE ANT ENCROACHMENT.

VEGETATION PROBLEM AREA 6. THICK HERBACEOUS GROWTH WITHIN STREAM CHANNEL AT STATION 200+00 - 202+00.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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VEGETATION PROBLEM AREA 7. THICK HERBACEOUS GROWTH WITHIN STREAM CHANNEL AT STATION 118+25.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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APPENDIX B

Exhibit Table B.1. Stream Problem Areas			
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation/Bar Formation	120+10	Sand Bar at Confluence	SP1
	118+80	Aggradation and Vegetation in Channel Influencing Channel Morphology	SP2
	118+25	Aggradation and Vegetation in Channel Influencing Channel Morphology	SP3
	200+00 - 202+00	Aggradation and Vegetation in Channel Influencing Channel Morphology	SP4
	111+70 - 111+80	Side Channel Bar	SP5
	102+25 - 102+40	Aggradation and Vegetation in Channel Influencing Channel Morphology	SP6
Bank Scour	116+92 - 117+10	Eroding Banks	SP7
Trash in Channel	102+20, 106+90, 112+00	Trash in Channel	SP8

STREAM PROBLEM AREA 1: SAND BAR LOCATED AT STATION 120+10.

STREAM PROBLEM AREA 2: AGGRADATION AND VEGETATION IN CHANNEL INFLUENCING CHANNEL MORPHOLOGY AT STATION 118+80.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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STREAM PROBLEM AREA 3: AGGRADATION AND VEGETATION IN CHANNEL INFLUENCING CHANNEL MORPHOLOGY AT STATION 118+25.

STREAM PROBLEM AREA 4: AGGRADATION AND VEGETATION IN CHANNEL INFLUENCING CHANNEL MORPHOLOGY AT STATION 200+00 - 202+00.

McADAMS	PROJECT NO. EEP-08030 FILENAME: EEP08030X.DWG SCALE: NTS DATE: 080-15-08	Ecosystem Enhancement Program	**UT to SANDY CREEK RESTORATION** **MONITORING PHOTOGRAPHS** **RANDOLPH COUNTY, NC**	**EcoEngineering** A division of The John R. McAdams Company, Inc. RESEARCH TRIANGLE PARK, NC P.O. BOX 14005 ZIP 27709-4005 (919) 361-5000

STREAM PROBLEM AREA 5. SIDE CHANNEL BAR AT STATION 111+70 - 111+80.

STREAM PROBLEM AREA 6. AGGRADATION AND VEGETATION IN CHANNEL INFLUENCING CHANNEL MORPHOLOGY AT STATION 102+25 - 102+40.

PROJECT NO.	EEP-08030
FILENAME:	EEP08030X.DWG
SCALE:	NTS
DATE:	080-15-08

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STREAM PROBLEM AREA 7. ERODING BANKS AT STATION 116+92 - 117+10.

STREAM PROBLEM AREA 8. TRASH IN CHANNEL AT STATION 112+00.

McADAMS	PROJECT NO. EEP-08030 FILENAME: EEP08030X.DWG SCALE: NTS DATE: 080-15-08	Ecosystem Enhancement Program	UT to SANDY CREEK RESTORATION MONITORING PHOTOGRAPHS RANDOLPH COUNTY, NC	EcoEngineering A division of The John R. McAdams Company, Inc. RESEARCH TRIANGLE PARK, NC P.O. BOX 14005 ZIP 27709-4005 (919) 361-5000

Table B2. Visual Morphological Stability Assessment
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,680 Linear Feet

Unnamed Tributary to Sandy Creek						
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state[1]	% Perform in Stable Condition[2]	Feature Perform. Mean or Total[3]
	1. Present ?[4]	25	25	NA	100	
	2. Armor stable (e.g. n o displacement)?	25	25	NA	100	
	3. Facet grade appears stable? (slope ≤ design range)	3	25	NA	12	
	4. Minimal evidence of embedding/fining?	25	25	NA	100	
A. Riffles	5. Length appropriate?	NA	NA	NA	NA	**78**
	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	31	31	NA	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	Max Pool / 1.2 > 1.6, 24 of 31	Design = 3.5/1.2 = 2.9 31	NA	77	
B. Pools	3. Length appropriate? (p-p spacing)	NA	NA	NA	NA	**89**
	1. Upstream of meander bend (run/inflection) centering?[5]	20	20	NA	100	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?[5]	19	20	NA	100	**100**
	1. Outer bend in state of limited/controlled erosion?	20	20	NA	100	
	2. Of those eroding, # w/concomitant point bar formation	20	20	NA	100	
	3. Apparent Rc within spec?	17	20	NA	85	
D. Meander	4. Sufficient floodplain access and relief?	20	20	NA	100	**95**

Table B2. Visual Morphological Stability Assessment UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601 Unnamed Tributary to Sandy Creek: 2,680 Linear Feet						
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	5/25	99	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	NA	100	**100**
F. Bank[6]	1. Actively eroding, wasting, or slumping bank	NA	1/18	NA	99	**99**
G. Vanes	1. Free of bank or arm scour?	21	21	NA	100	
	2. Height appropriate?	21	21	NA	100	
	3. Angle and geometry appear appropriate?	21	21	NA	100	
	4. Free of piping or other structural failures?	21	21	NA	100	**100**
H. Wads/ Boulders	1. Free of scour?	NA	NA	NA	100	
	2. Footing stable?	NA	NA	NA	100	**100**

UT to Sandy Creek - Tributary						
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state[1]	% Perform in Stable Condition[2]	Feature Perform. Mean or Total[3]
A. Riffles	1. Present ?[4]	7	7	NA	100	
	2. Armor stable (e.g. n o displacement)?	7	7	NA	100	
	3. Facet grade appears stable? (slope ≤ design range)	5	7	NA	71	
	4. Minimal evidence of embedding/fining?	7	7	NA	100	
	5. Length appropriate?	NA	NA	NA	NA	**93**
	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	5	5	NA	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	Max Pool / 0.5 > 1.6, 4 of 5	Design = 1.9/0.5 = 3.8 5	NA	80	

Table B2. Visual Morphological Stability Assessment UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601 Unnamed Tributary to Sandy Creek: 2,680 Linear Feet						
B. Pools	3. Length appropriate? (p-p spacing)	NA	NA	NA	NA	**90**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?[5]	7	8	NA	100	
C. Thalweg	2. Downstream of meander (glide/inflection) centering?[5]	8	8	NA	100	**100**
D. Meander	1. Outer bend in state of limited/controlled erosion?	8	8	NA	100	
	2. Of those eroding, # w/concomitant point bar formation	8	8	NA	100	
	3. Apparent Rc within spec?	8	8	NA	100	
	4. Sufficient floodplain access and relief?	8	8	NA	100	**100**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	1/200	48	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	NA	100	**74**
F. Bank[6]	1. Actively eroding, wasting, or slumping bank	NA	NA	NA	100	**100**
G. Vanes	1. Free of bank or arm scour?	5	5	NA	100	
	2. Height appropriate?	5	5	NA	100	
	3. Angle and geometry appear appropriate?	5	5	NA	100	
	4. Free of piping or other structural failures?	5	5	NA	100	**100**
H. Wads/ Boulders	1. Free of scour?	NA	NA	NA	100	
	2. Footing stable?	NA	NA	NA	100	**100**

Table B2. Visual Morphological Stability Assessment
UT to Sandy Creek Stream Restoration Project/EEP Project ID: 040611601
Unnamed Tributary to Sandy Creek: 2,680 Linear Feet

Footnotes:

The above table should be completed using the visual assessment data form for each project reach/segment It is recognized that the various metrics within a feature category may not have equal influence on the overall stability of that feature and that this does not incorporate weighting or scoring; however, at this time, EEP requires documentation of the relevant observations for these feature categories.

1 Metrics that are spatial estimates that are continuous variables should be entered as:

The number of locales over the reach for which the failing condition is observed / followed by the total linear distance (feet) or area for which the failing or unstable condition is observed.

2 In the case of categorical metrics for which a feature count is involved, this is simply calculated as the number of functional features that are in a state of stability as a percentage of the total. In the case of those metrics based on footage or aerial extent it is that amount in a state of failure or instability expressed as a proportion of the total amount of that feature. The resulting proportion is then subtracted from land then multiplied by 100 to give a percentage that represents the proportion of that feature category in a state of apparent stability.

3 The mean of the metrics for a given feature category.

4 Was the feature actually present as compared to the As-built or has the feature been completely obscured (aggraded) or removed (degraded).

5 Is the Thalweg centering up on the channel in between meander bends?

6 Amount of active bank failure/erosion. This should be the tally of all stressed and failing bank from the problem area plan view, which an then be calculated as indicated in footnote 1 above.

USDA-NRCS (1998) *Stream Visual Assessment Protocol* National Water and Climate Center (Technical Note 99–1)
Rosgen, D L. (1996) *Applied River Morphology* . Wildland Hydrology Books, Pagosa Springs, CO.
Phankuch, D.J. (1975) Stream reach inventory and channel stability evaluation. USDA Forest Service, R1-75-002. GPO #696-260/200

1-YEAR, 2008 SURVEY DATA

PROJECT NAME UT TO SANDY CREEK

TASK LONGITUDINAL PROFILE

FEATURE/FACET SLOPE LENGTH, AND SPACING AND LONGITUDINAL PROFILE DATA

REACHES UT to Sandy Creek and Minor Tributary

DATE 10/01/2008 to 10/03/2008

CREW ALTIZER/BUCHHOLZ/HALLEY/FURRY

UT to Sandy Creek

Overall water surface slope =	0.9%		**DESIGN**	**AVG.**
			Riffle	0.4%
WS sta. start =	10073.38 ft		Run	---
WS sta. end =	12343.93 ft		p-p spacing	62
ELEV. Start =	579.65 ft msl			
ELEV. End =	559.41 ft msl	Results		

	n =	MIN.	MEDIAN.	AVG.	MAX.
Riffle slopes measured =	25	0.0%	0.8%	1.3%	6.2%
Run slopes measured =	20	0.0%	3.1%	4.0%	17.8%
Pools measured =	31	7	71	74	175

Minor Tributary

Overall water surface slope =	1.9%		**DESIGN**	**AVG.**
			Riffle	1.7%
WS sta. start =	20049.74 ft		Run	---
WS sta. end =	20363.85 ft		p-p spacing	46
ELEV. Start =	572.44 ft msl			
ELEV. End =	566.50 ft msl	Results		

	n =	MIN.	MEDIAN.	AVG.	MAX.
Riffle slopes measured =	7	0.3%	0.9%	1.4%	3.6%
Run slopes measured =	5	3.5%	4.2%	7.6%	14.6%
Pools measured =	5	32	52	53	77

All data reported in units of **feet** unless otherwise specified. Elevation data is presented in feet mean sea level.

Feature	Start sta.	End sta.	Length	WS El. Start	WS El. End	Change	Slope
UT to Sandy Creek							
Riffle	10073	10084	11	579.65	579.48	0.17	1.6%
Riffle	10131	10160	29	579.16	578.40	0.76	2.6%
Riffle	10198	10220	22	578.14	578.02	0.12	0.5%
Riffle	10250	10280	30	578.18	578.01	0.17	0.6%
Riffle	10335	10354	19	577.31	577.03	0.28	1.5%
Riffle	10408	10434	26	576.86	576.31	0.55	2.1%
Riffle	10454	10498	44	576.22	575.84	0.38	0.9%
Riffle	10566	10580	14	575.42	575.36	0.06	0.4%
Riffle	10647	10680	34	574.20	574.10	0.10	0.3%
Riffle	10742	10761	19	573.66	573.54	0.12	0.6%
Riffle	10829	10837	8	572.58	572.52	0.06	0.8%
Riffle	10906	10915	9	572.15	571.98	0.17	1.8%
Riffle	11006	11019	14	570.81	569.95	0.86	6.2%
Riffle	11047	11056	9	569.60	569.41	0.19	2.1%
Riffle	11099	11105	7	569.11	569.07	0.04	0.6%
Riffle	11154	11168	15	568.99	568.91	0.08	0.5%
Riffle	11270	11297	27	567.80	567.24	0.56	2.1%
Riffle	11364	11375	11	566.37	566.09	0.28	2.5%

Riffle	11404	11429	26	566.10	566.00	0.10	0.4%
Riffle	11701	11775	74	564.16	563.60	0.56	0.8%
Riffle	11852	11893	41	561.88	561.86	0.02	0.0%
Riffle	11937	11951	14	561.11	561.04	0.07	0.5%
Riffle	12010	12039	29	561.08	560.95	0.13	0.4%
Riffle	12149	12203	54	560.81	560.49	0.32	0.6%
Riffle	12329	12344	15	559.74	559.41	0.33	2.1%

n =	25
MIN =	0.0%
MEDIAN =	0.8%
AVG. =	1.3%
MAX =	6.2%

Minor Tributary

Riffle	20049.74	20057.69	7.95	572.44	572.15	0.29	3.6%
Riffle	20072.82	20106.09	33.27	572.02	571.50	0.52	1.6%
Riffle	20145.91	20180.00	34.09	570.16	569.87	0.29	0.9%
Riffle	20207.78	20234.63	26.85	568.90	568.30	0.60	2.2%
Riffle	20259.04	20272.12	13.08	567.48	567.38	0.10	0.8%
Riffle	20297.10	20315.51	18.41	567.21	567.16	0.06	0.3%
Riffle	20340.34	20363.85	23.51	566.63	566.50	0.13	0.6%

n =	7
MIN =	0.3%
MEDIAN =	0.9%
AVG. =	1.4%
MAX =	3.6%

Feature	Start sta.	End sta.	Length	WS El. Start	WS El. End	Change	Slope
UT to Sandy Creek							
Run	10084	10094	10	579.48	579.28	0.20	2.0%
Run	10160	10162	1	578.40	578.14	0.26	17.8%
Run	10280	10313	33	578.01	577.31	0.70	2.1%
Run	10354	10366	12	577.03	576.86	0.17	1.4%
Run	10434	10454	20	576.31	576.22	0.09	0.4%
Run	10498	10507	9	575.84	575.42	0.42	4.5%
Run	10580	10596	16	575.36	574.20	1.16	7.5%
Run	10680	10693	13	574.10	573.79	0.31	2.4%
Run	10761	10783	23	573.54	572.58	0.96	4.2%
Run	10837	10845	8	572.52	572.15	0.37	4.5%
Run	10915	10930	15	571.98	571.65	0.33	2.3%
Run	10964	10971	7	570.81	570.81	0.00	0.0%
Run	11019	11029	10	569.95	569.60	0.35	3.5%
Run	11056	11064	8	569.41	569.11	0.30	3.7%
Run	11105	11117	12	569.07	569.04	0.03	0.3%
Run	11168	11176	8	568.91	568.11	0.80	10.6%
Run	11297	11313	17	567.24	566.37	0.87	5.2%
Run	11775	11803	28	563.60	562.14	1.46	5.2%
Run	12039	12087	48	560.95	560.81	0.14	0.3%
Run	12203	12209	6	560.49	560.34	0.15	2.6%

n =	20
MIN =	0.0%
MEDIAN =	3.1%
AVG. =	4.0%
MAX =	17.8%

Minor Tributary							
Run	20106	20121	15	571.50	570.86	0.64	4.2%
Run	20180	20197	17	569.87	569.29	0.58	3.5%
Run	20235	20242	7	568.30	567.49	0.81	11.6%
Run	20316	20325	9	567.16	566.79	0.37	3.9%
Run	20364	20368	4	566.50	565.87	0.63	14.6%

n =	5
MIN =	3.5%
MEDIAN =	4.2%
AVG. =	7.6%
MAX =	14.6%

Feature	Start sta.	End sta.	Length	p-p spacing
Sandy Creek				
Pool	10033	10062	30	
Pool	10095	10114	19	62
Pool	10162	10169	8	67
Pool	10179	10193	14	18
Pool	10220	10243	23	41
Pool	10313	10335	21	93
Pool	10366	10406	40	53
Pool	10507	10546	39	141
Pool	10596	10635	39	89
Pool	10701	10708	7	106
Pool	10709	10742	33	7
Pool	10783	10814	31	75
Pool	10845	10902	57	62
Pool	10930	10944	15	85
Pool	10952	10961	9	22
Pool	11029	11047	18	77
Pool	11064	11095	31	35
Pool	11117	11154	36	53
Pool	11176	11201	25	59
Pool	11211	11259	48	35
Pool	11313	11348	35	102
Pool	11429	11437	7	116
Pool	11441	11453	11	12
Pool	11556	11589	33	115
Pool	11673	11685	12	117
Pool	11803	11817	13	131
Pool	11819	11845	25	16
Pool	11951	12004	53	131
Pool	12126	12149	24	175
Pool	12209	12225	17	83
Pool	12245	12270	25	36

n =	31	
MIN =	7	(p-p spacing)
MEDIAN =	71	
AVG. =	74	
MAX =	175	

Minor Tributary				
Pool	20060	20073	13	
Pool	20121	20130	8	61
Pool	20198	20202	4	77
Pool	20242	20249	8	44
Pool	20274	20294	20	32

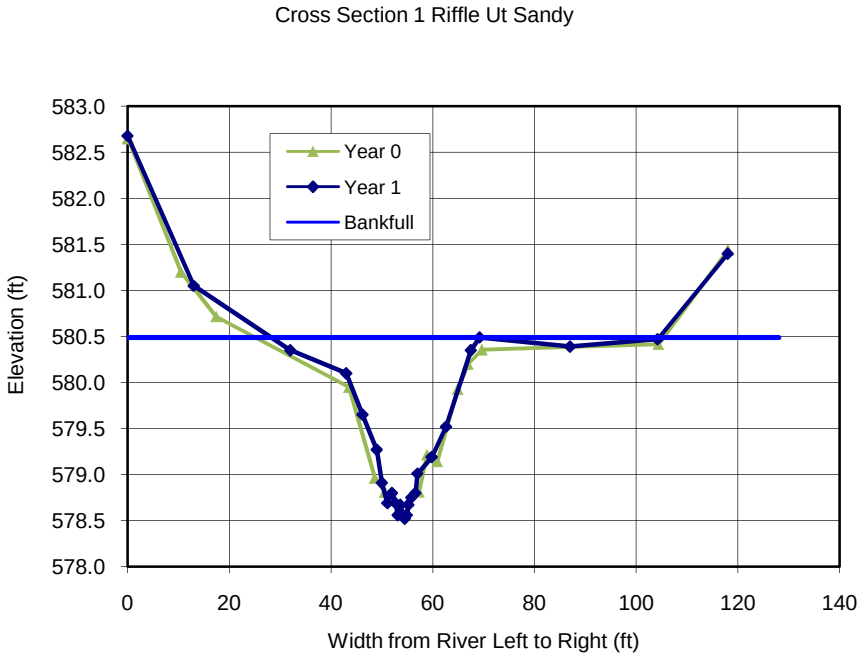
n =	5	
MIN =	32	(p-p spacing)
MEDIAN =	52	
AVG. =	53	
MAX =	77	

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK
CROSS-SECTION: 1 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Riffle **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0	583.18	TOP LB
0	582.68	Next to Pin LB
13	581.05	GN
32	580.35	GN
43	580.1	GN
46	579.65	GN
49	579.27	GN
50	578.91	EW WS
51	578.69	BD
52	578.8	BD
53	578.69	BD
53	578.56	BD
54	578.67	BD
54	578.57	BD
55	578.52	TW
55	578.56	BD
55	578.67	BD
55.8	578.75	BD
56.6	578.8	BD
57	579.01	GN
59.8	579.19	GN
62.6	579.52	GN
67.5	580.35	GN
69.2	580.49	BKF
87	580.39	GN
104.2	580.47	GN
118	581.4	Next to Pin RB
118	581.04	TOP OF PIN RB

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

Bankfull X-sec area		31.8
Bankfull Width		41.0
Bankfull Mean Depth		0.8
Bankfull Max Depth		2.0
Width/Depth Ratio		52.8
Entrenchment Ratio		2.7
Classification		C

Remarks:

Ecosystem Enhancement Program

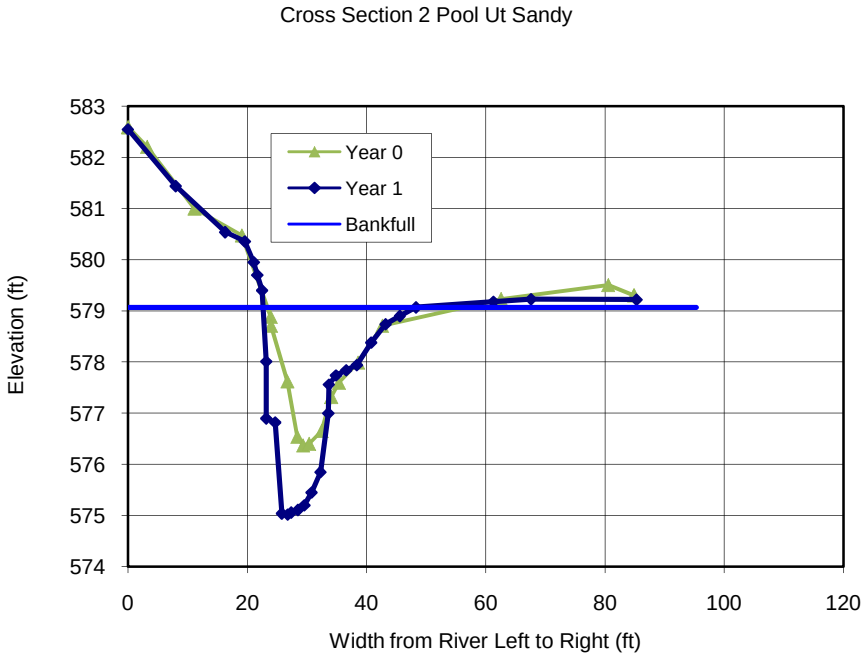
Figure X

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK
CROSS-SECTION: 2 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Pool **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0	583.04	Top LB
0	582.55	Next to Pin
8	581.44	GN
16	580.54	GN
20	580.36	GN
21	579.95	GN
22	579.7	GN
23	515.32	GN
23	578.01	EW WS
23	576.9	BD
25	576.82	BD
26	575.04	BD
27	575.02	TW
27	575.06	BD
29	575.11	BD
30	575.2	BD
31	575.45	BD
32.3	575.85	BD
33.6	577	BD
33.7	577.56	GN
34.9	577.74	GN
36.6	577.84	GN
38.4	577.94	GN
40.8	578.38	GN
43.2	578.74	GN
45.6	578.9	GN
48.3	579.07	BKF
61.3	579.18	GN
67.6	579.23	GN
85.3	579.22	Next to Pin
85.3	579.77	TOP OF PIN RB

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

Bankfull X-sec area		45.6
Bankfull Width		25.6
Bankfull Mean Depth		1.8
Bankfull Max Depth		4.1
Width/Depth Ratio		14.4
Entrenchment Ratio		n/a
Classification		n/a

Remarks:

Ecosystem Enhancement Program

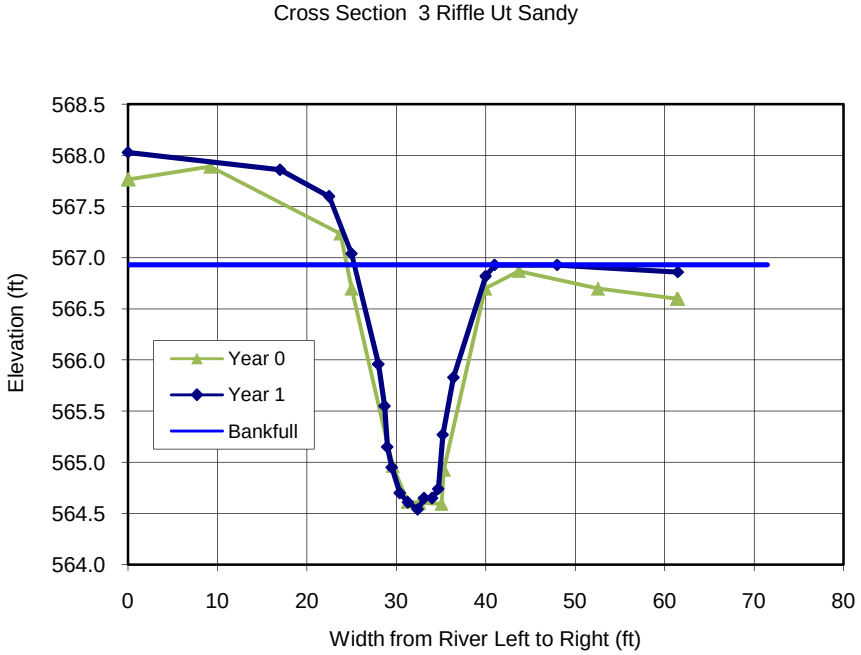
Figure X

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK
CROSS-SECTION: 3 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Riffle **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0.0	568.5	Top LB
0.0	568.0	Next to Pin
17.0	567.9	GN
22.5	567.6	GN
25.0	567.0	GN
28.0	566.0	GN
28.7	565.6	GN
29.0	565.2	EW WS
29.5	565.0	BD
30.4	564.7	BD
31.3	564.6	BD
32.4	564.5	TW
33.1	564.7	BD
34.0	564.7	BD
34.7	564.7	BD
35.2	565.3	GN
36.4	565.8	GN
40.0	566.8	GN
41.0	566.9	BKF
48.0	566.9	GN
61.5	566.9	Next to Pin
61.5	567.2	TOP OF PIN

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

Bankfull X-sec area	20.2
Bankfull Width	15.7
Bankfull Mean Depth	1.3
Bankfull Max Depth	2.4
Width/Depth Ratio	12.2
Entrenchment Ratio	6.4
Classification	C

Remarks:

Ecosystem Enhancement Program

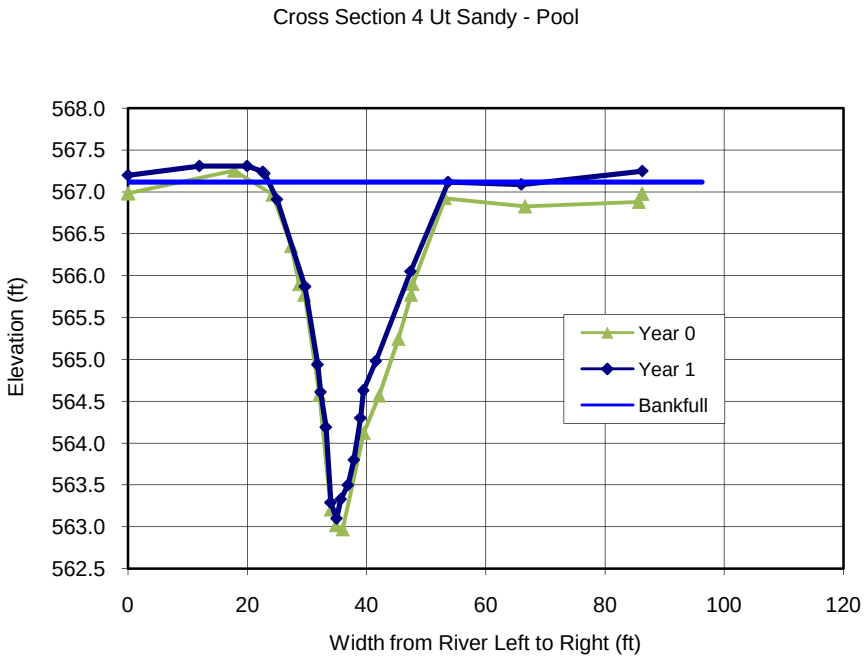
Figure X

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK
CROSS-SECTION: 4 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Pool **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0	567.61	Top LB
0	567.2	Next to Pin
12	567.31	GN
20	567.31	GN
23	567.24	GN
23	567.22	GN
25	566.91	GN
30	565.87	GN
32	564.94	GN
32	564.61	EW WS
33	564.19	BD
34	563.29	BD
35	563.1	TW
36	563.33	BD
37	563.5	BD
38	563.8	BD
39	564.3	BD
39.5	564.63	WS
41.6	564.98	GN
47.4	566.05	GN
53.7	567.12	BKF
66	567.09	GN
86.3	567.25	Next to Pin
86.3	567.85	TOP OF PIN RB

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

Bankfull X-sec area	50.3
Bankfull Width	30.1
Bankfull Mean Depth	1.7
Bankfull Max Depth	4.0
Width/Depth Ratio	18.0
Entrenchment Ratio	n/a
Classification	n/a

Remarks:

Ecosystem Enhancement Program

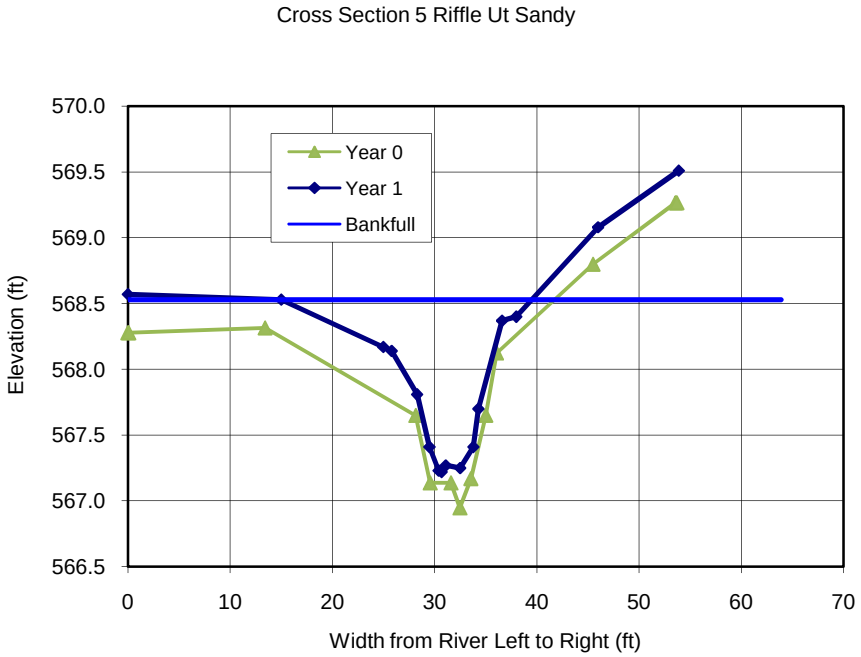
Figure X

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK - TRIBUTARY
CROSS-SECTION: 5 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Riffle **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0	568.95	Top of Pin LB
0	568.57	Next to Pin
15	568.53	BKF
25	568.17	GN
26	568.14	GN
28	567.81	GN
30	567.41	EW WS
30	567.23	BD
31	567.22	TW
31	567.27	BD
33	567.25	BD
34	567.41	EW
34	567.7	GN
37	568.37	GN
38	568.4	GN
46	569.08	GN
54	569.51	Next to Pin
53.9	570.3	Top of Pin RB

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

Bankfull X-sec area	11.9
Bankfull Width	24.5
Bankfull Mean Depth	0.5
Bankfull Max Depth	1.3
Width/Depth Ratio	50.8
Entrenchment Ratio	4.1
Classification	C

Remarks: Tributary

Ecosystem Enhancement Program

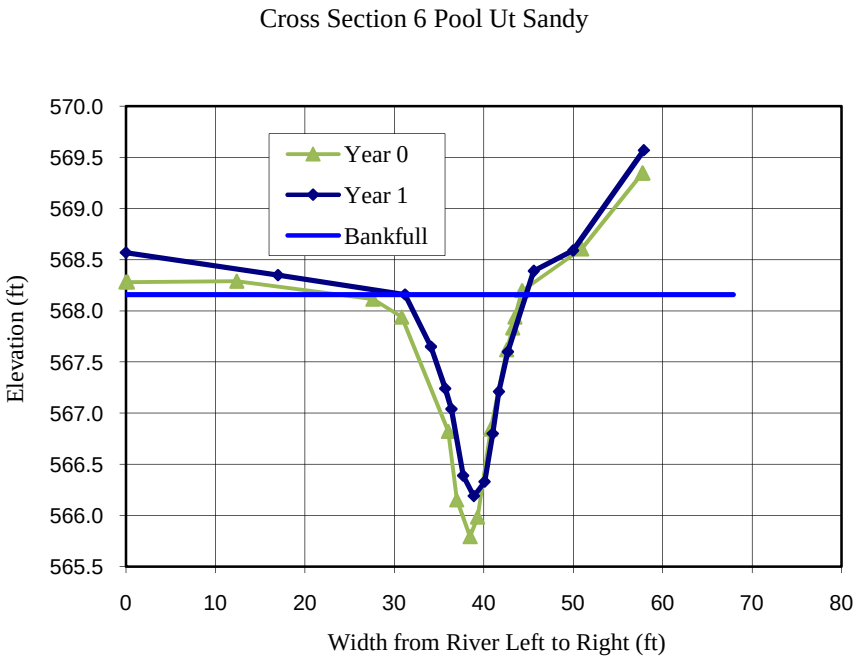
Figure X

PROJECT ID: 040611601 **1-YEAR, 2008 SURVEY DATA**

PROJECT SANDY CREEK
TASK CROSS SECTION
REACH SANDY CREEK - TRIBUTARY
CROSS-SECTION: 6 **DATE** 10/01/2008 to 10/03/2008
FEATURE: Pool **CREW** ALTIZER/BUCHHOLZ/HALLEY/FURRY

Station (ft)	Elevation(ft)	Remark
0	568.95	TOP LB
0	568.57	NEXT TO PIN
17	568.35	GN
31	568.16	BKF
34	567.65	GN
36	567.24	EW WS
36	567.04	BD
38	566.39	BD
39	566.19	TW
40	566.33	BD
41	566.8	BD
42	567.21	EW
43	567.6	GN
46	568.39	GN
50	568.59	GN
58	569.57	NEXT TO PIN
58	570.09	TOP OF PIN RB

CROSS SECTION PHOTO - LOOKING DOWNSTREAM



CROSS SECTION PLOT - LOOKING DOWNSTREAM

Summary Data
All dimensions in feet.

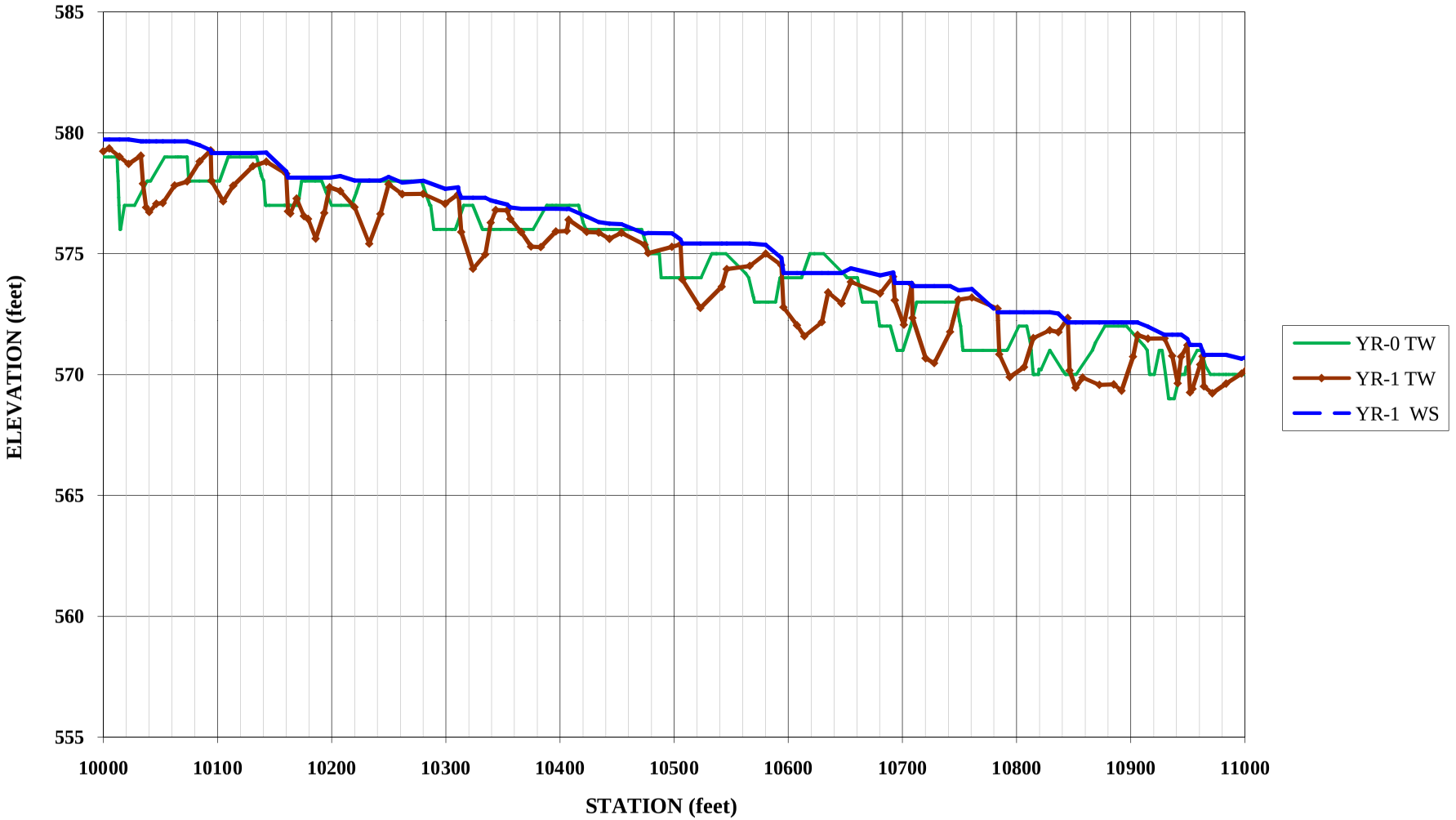
Bankfull X-sec area		12.6
Bankfull Width		13.6
Bankfull Mean Depth		0.9
Bankfull Max Depth		2.0
Width/Depth Ratio		14.6
Entrenchment Ratio		7.4
Classification		n/a

Remarks: Tributary

Ecosystem Enhancement Program

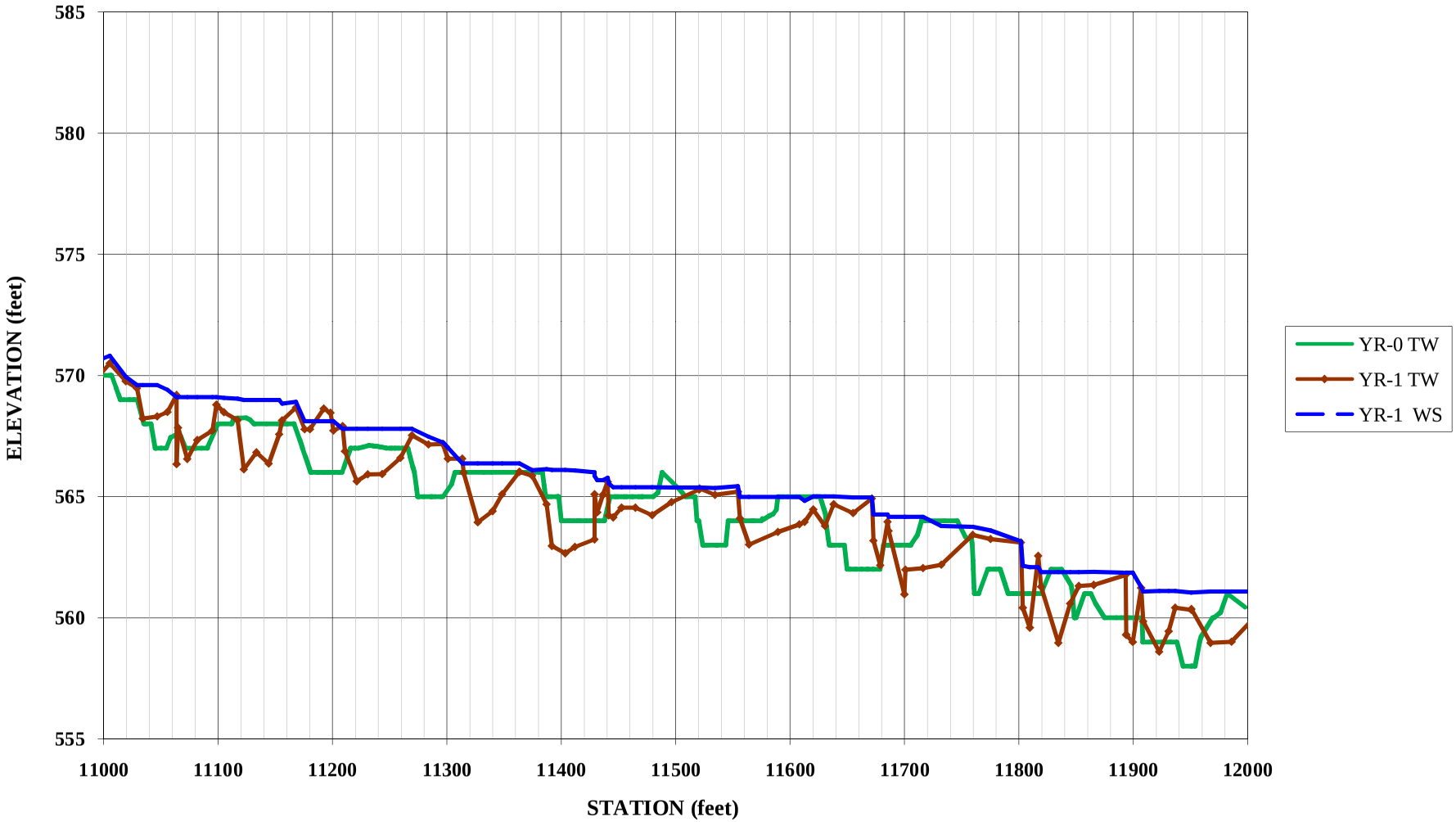
Figure X

UT to Sandy Creek
Longitudinal Profile
2008 (1-Year) Monitoring



EcoEngineering
A division of The John R. McAdams Company, Inc.

UT to Sandy Creek
Longitudinal Profile
2008 (1-Year) Monitoring



EcoEngineering
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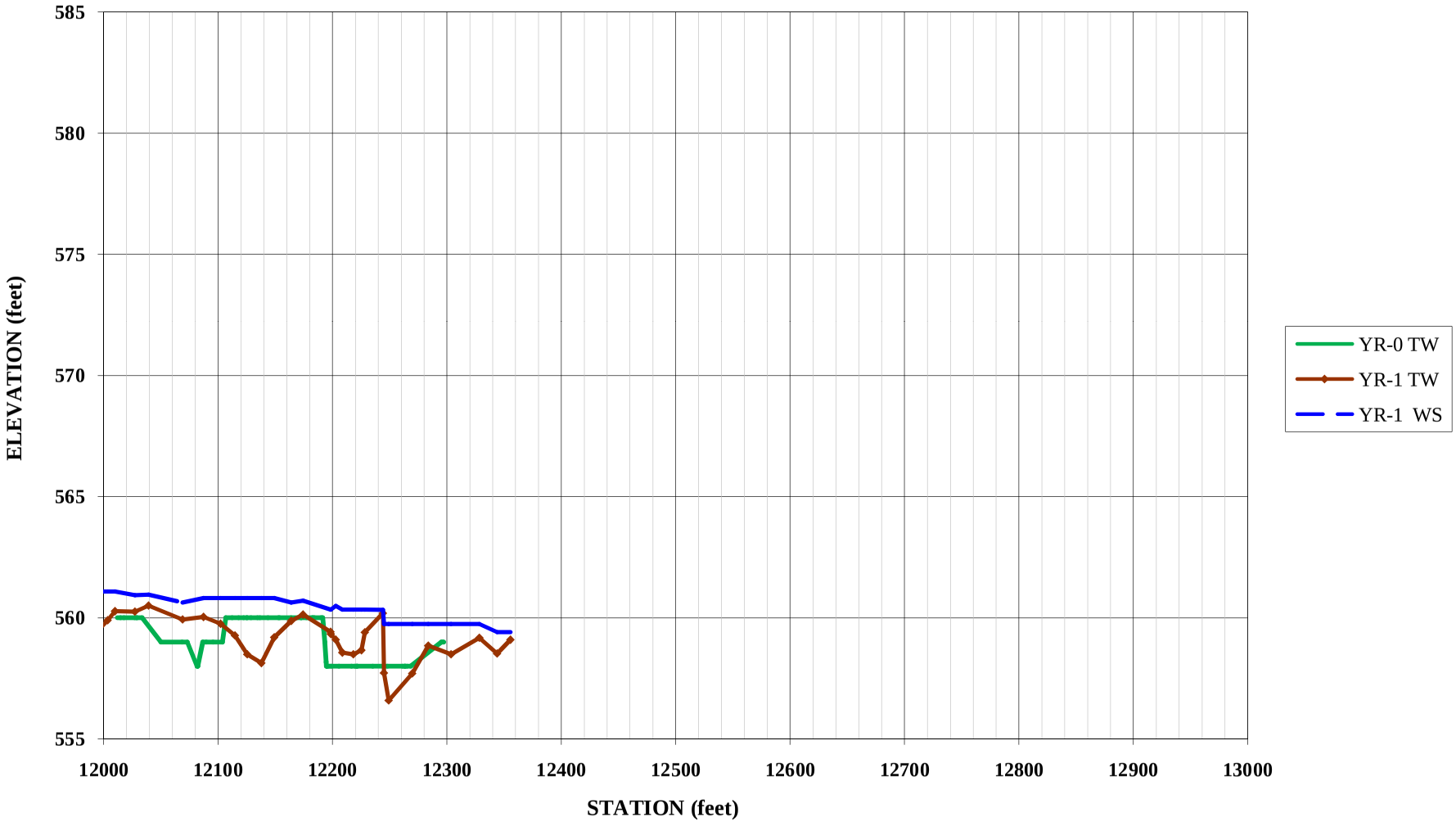
UT to Sandy Creek
Longitudinal Profile
2008 (1-Year) Monitoring



EcoEngineering
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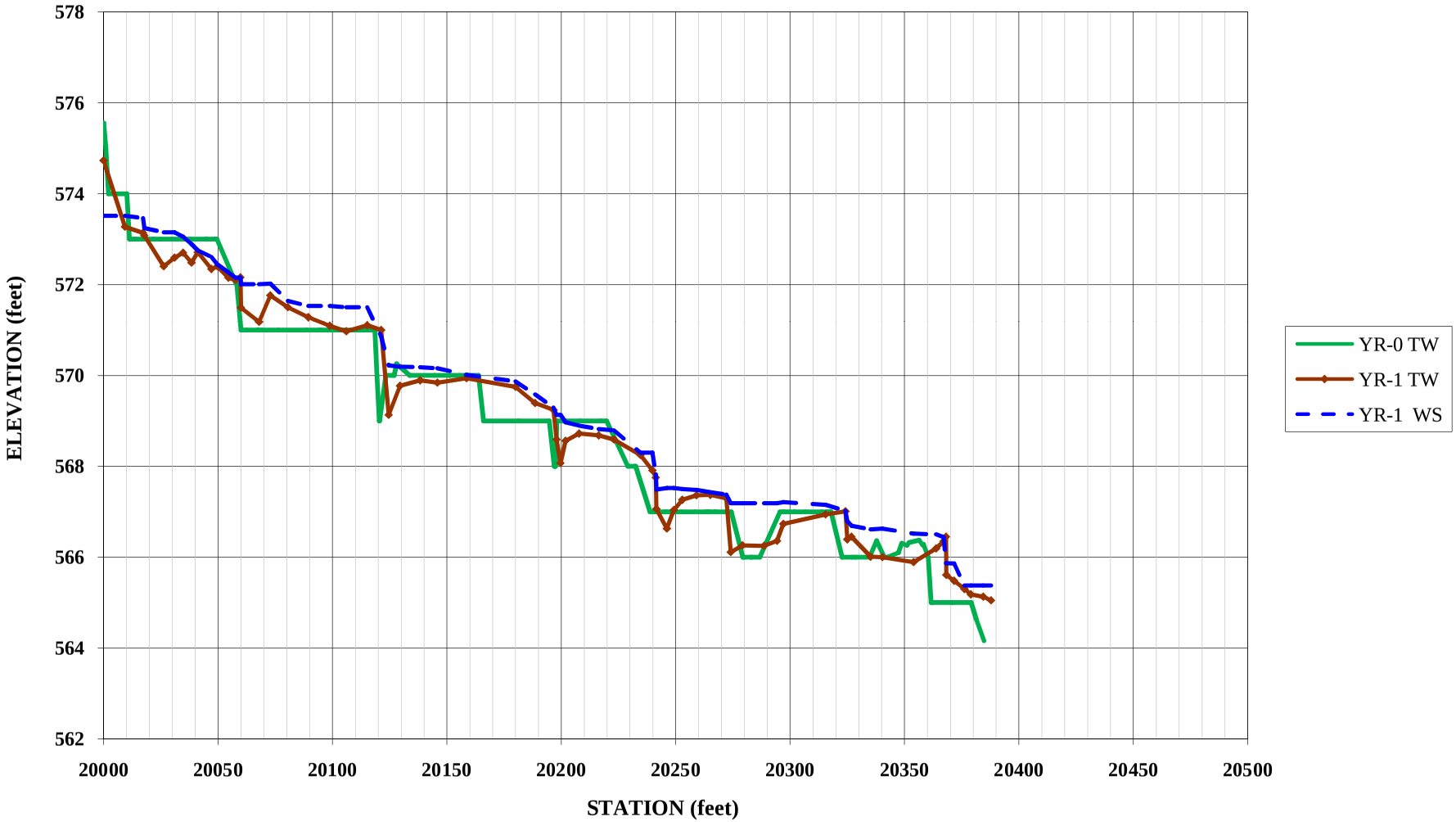
UT to Sandy Creek - Tributary
Longitudinal Profile
2008 (1-Year) Monitoring



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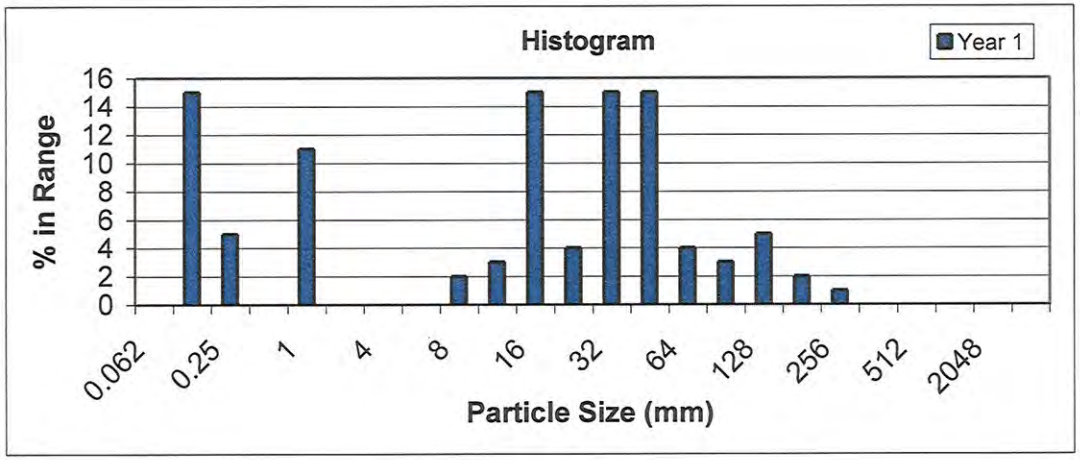


PROJECT ID: 040611601
CROSS-SECTION: 1 **FEATURE: RIFFLE**

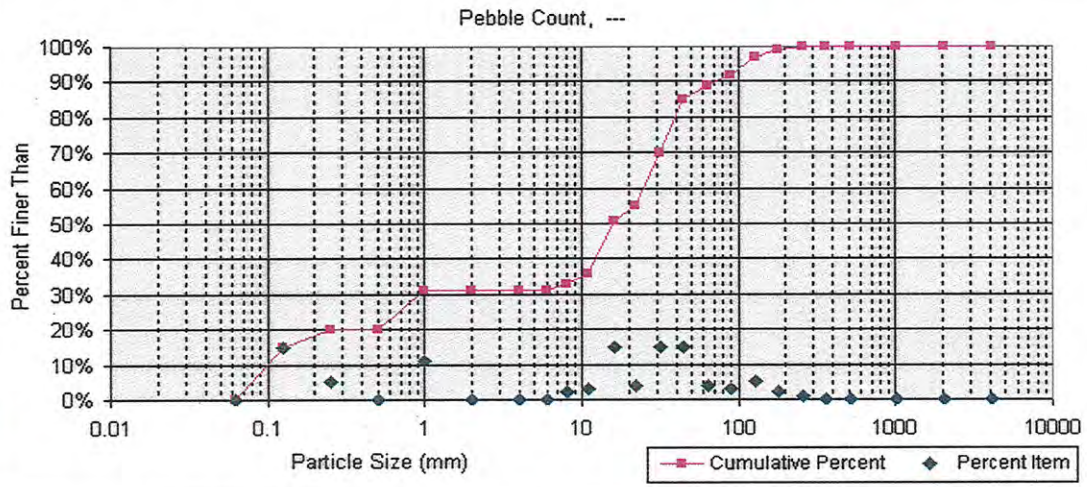
Ecosystem Enhancement PROGRAM

PROJECT UT to SANDY CREEK
TASK PEBBLE COUNT
REACH UT to SANDY CREEK
DATE 10/01/2008 to 10/03/2008
CREW ALTIZER/BUCHHOLZ/HALLEY/FURRY

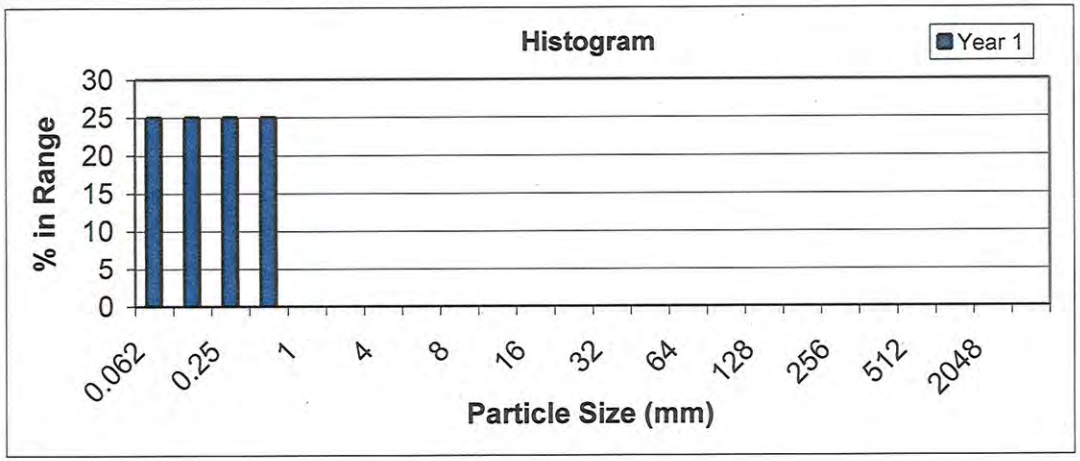
Pebble Count

Material	Size Range (mm)		Count
silt/clay	0	0.062	**0**
very fine sand	0.062	0.13	**15**
fine sand	0.13	0.25	**5**
medium sand	0.25	0.5	
coarse sand	0.5	1	**11**
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	
fine gravel	6	8	**2**
medium gravel	8	11	**3**
medium gravel	11	16	**15**
coarse gravel	16	22	**4**
coarse gravel	22	32	**15**
very coarse gravel	32	45	**15**
very coarse gravel	45	64	**4**
small cobble	64	90	**3**
medium cobble	90	128	**5**
large cobble	128	180	**2**
very large cobble	180	256	**1**
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
bedrock			
	Total Particle Count:		100

Note: ---



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.144	9.89	15.6	44	111	0%	31%	58%	11%	0%	0%



PROJECT ID: 040611601
CROSS-SECTION: 3 **FEATURE: RIFFLE**

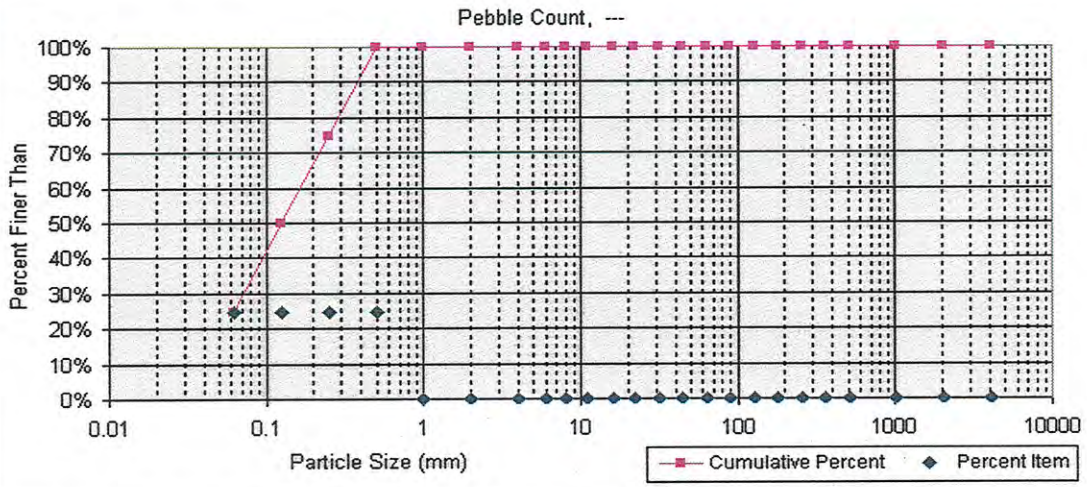
Ecosystem Enhancement PROGRAM

PROJECT UT to SANDY CREEK
TASK PEBBLE COUNT
REACH UT to SANDY CREEK
DATE 10/01/2008 to 10/03/2008
CREW ALTIZER/BUCHHOLZ/HALLEY/FURRY

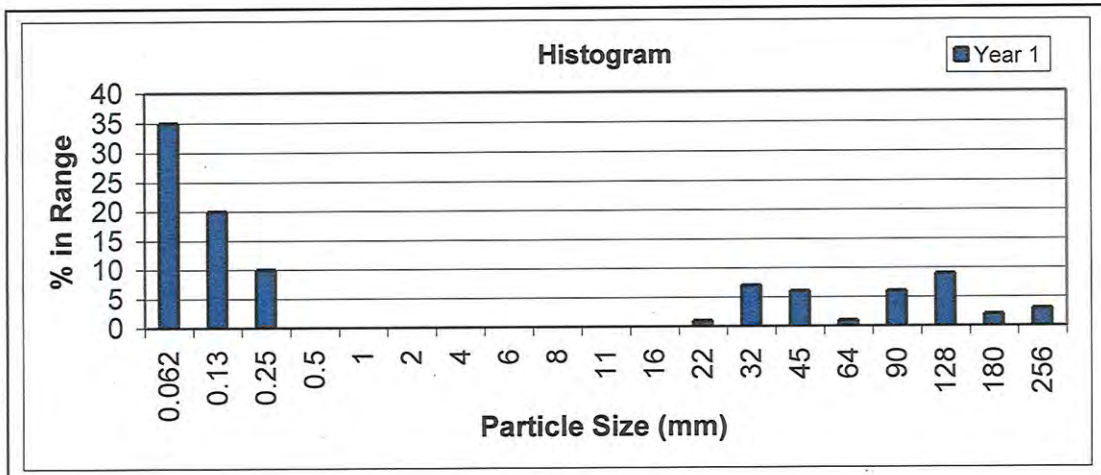
Pebble Count

Material	Size Range (mm)		Count
silt/clay	0	0.062	25
very fine sand	0.062	0.13	25
fine sand	0.13	0.25	25
medium sand	0.25	0.5	25
coarse sand	0.5	1	
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	
fine gravel	6	8	
medium gravel	8	11	
medium gravel	11	16	
coarse gravel	16	22	
coarse gravel	22	32	
very coarse gravel	32	45	
very coarse gravel	45	64	
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
bedrock			
	Total Particle Count:		100

Note: ---



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	0.08	0.1	0	0	25%	75%	0%	0%	0%	0%



PROJECT ID: 040611601
CROSS-SECTION: 5 **FEATURE: RIFFLE**

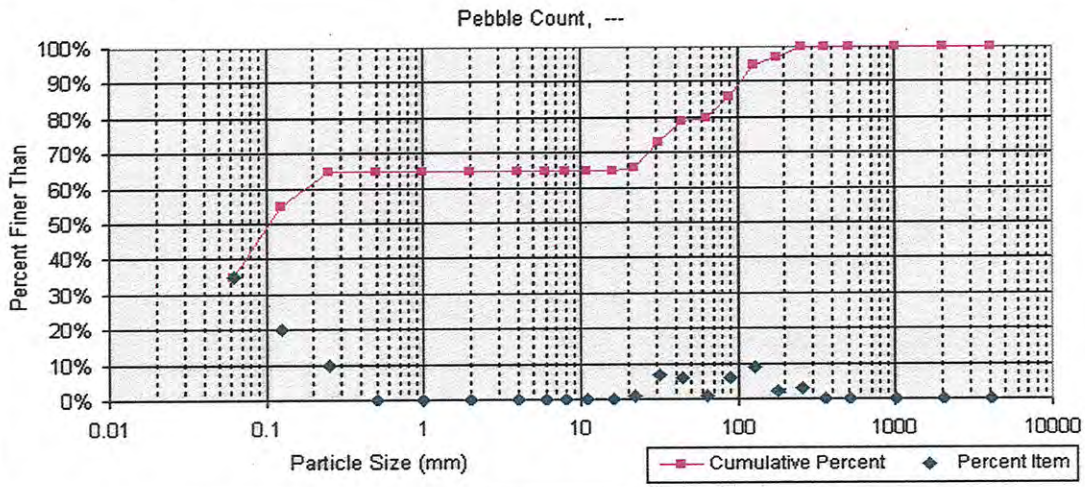
Ecosystem Enhancement PROGRAM

PROJECT UT to SANDY CREEK
TASK PEBBLE COUNT
REACH UT to SANDY CREEK
DATE 10/01/2008 to 10/03/2008
CREW ALTIZER/BUCHHOLZ/HALLEY/FURRY

Pebble Count

Material	Size Range (mm)		Count
silt/clay	0	0.062	**35**
very fine sand	0.062	0.13	**20**
fine sand	0.13	0.25	**10**
medium sand	0.25	0.5	
coarse sand	0.5	1	
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	
fine gravel	6	8	
medium gravel	8	11	
medium gravel	11	16	
coarse gravel	16	22	**1**
coarse gravel	22	32	**7**
very coarse gravel	32	45	**6**
very coarse gravel	45	64	**1**
small cobble	64	90	**6**
medium cobble	90	128	**9**
large cobble	128	180	**2**
very large cobble	180	256	**3**
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
bedrock			
	Total Particle Count:		100

Note: ---



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	0.06	0.1	80	128	35%	30%	15%	20%	0%	0%

APPENDIX C

No wetlands monitored at this site.

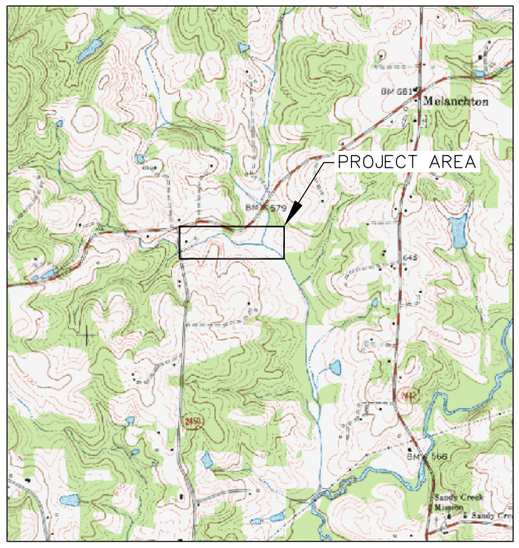
Appendix D

UT TO SANDY CREEK

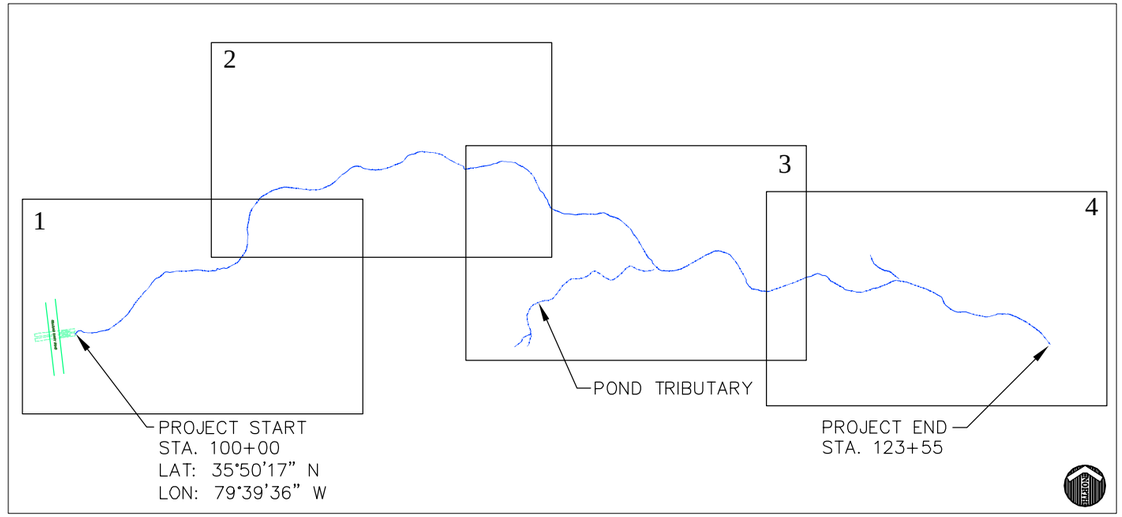
STREAM RESTORATION PROJECT - YEAR ONE MONITORING

RANDOLPH COUNTY, NORTH CAROLINA
STATE PROJECT NUMBER: 040611601
DATE: NOVEMBER 5, 2008

NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM
NC-EEP CONTACT: MELONIE ALLEN (919) 715-1973



VICINITY MAP
NTS



CONTROL TABLE				
POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	761096.82	1804283.17	604.12	GS FAY-3 NCDOT
3	760572.44	1804562.50	586.59	TRAV
4	760923.56	1804836.83	575.70	TRAV
5	760864.93	1805782.55	565.77	TRAV
6	760953.87	1804700.65	581.55	BM 1 IRS 1/2
7	760999.25	1805260.24	576.72	BM 2 IRS 1/2
8	760921.29	1805746.59	568.03	BM 3 IRS 1/2
501	760539.44	1804403.40	585.47	NAIL SET
502	760812.18	1804778.30	577.51	NAIL SET
503	760985.74	1805071.64	574.80	NAIL SET
504	760714.98	1805598.90	566.93	NAIL SET
505	760663.85	1806056.94	564.44	NAIL SET
5001	760689.52	1804465.13	583.18	X-SEC1LT(TT20)
5002	760604.10	1804546.58	581.97	X-SEC1RT(TT21)
5003	760658.08	1804584.06	579.79	X-SEC2RT(TTPT23)
5004	760736.88	1804552.53	583.04	X-SEC2LT(TTPT22)
5005	760679.38	1805448.41	570.08	X-SEC6RT(TTPT30)
5006	760690.86	1805414.54	570.30	X-SEC5RT(TTPT28)
5007	760736.90	1805442.44	568.95	X-SEC5/6LT(PT29)
5008	760751.13	1805571.36	568.50	X-SEC3LT
5009	760693.80	1805593.56	567.24	X-SEC3RT
5010	760704.95	1805653.55	567.85	X-SEC4RT
5011	760790.71	1805662.60	567.61	X-SEC4LT
9900	760620.66	1804510.60	580.97	NLF
9901	760679.11	1804723.68	577.63	NLF
9902	760923.80	1804836.79	575.62	TI NLF 4
9903	760914.33	1805065.26	574.81	NLS
9904	760955.55	1805335.31	576.39	NLS
9905	760818.90	1805536.38	568.47	NLS
9906	760833.61	1805765.78	566.14	NLS
9907	760690.08	1805974.43	565.64	NLS
9908	760999.44	1805570.42	587.15	NLS
9909	761073.35	1805201.41	590.62	NLS
9910	761181.75	1804709.24	596.94	NLS
9911	761096.82	1804283.17	604.12	TI 1
9912	760595.72	1804329.27	591.20	TI 2
9913	760528.75	1804383.66	589.04	TI 123
9914	760725.38	1805628.07	567.05	NLS
9915	760651.83	1804521.18	580.06	NLF
9916	760917.91	1804986.69	573.58	NLS
9917	761012.69	1805022.84	576.62	NLS
9918	761006.02	1805180.43	575.10	NLS
9919	760783.20	1805305.43	571.09	NLS
9920	760758.60	1804752.58	577.37	NLS
9921	760629.03	1804839.28	587.57	NLS
9922	761030.59	1804706.32	585.90	NLS
9923	760955.49	1804994.15	573.60	NLS
9924	760715.22	1805939.13	566.22	NLS
9925	760582.71	1806288.27	562.28	NAI
9926	760976.47	1805070.00	574.09	NLS
9950	760544.95	1804479.63	583.08	IRF W\DISC

SHEET INDEX

EcoEngineering
A division of The John R. McAdams Company, Inc.
ENGINEERS/PLANNERS/SURVEYORS
RESEARCH TRIANGLE PARK, NC
P.O. BOX 14005 ZIP 27709-4005
(919) 361-5000

LEGEND

- EASEMENT MARKER FOUND
- IRON MARKER FOUND
- OVERHEAD WIRE
- EXISTING FENCE LINE
- THALWEG OF CREEK
- INTERMEDIATE CONTOUR
- INDEX CONTOUR
- TOB OF BANK
- BOTTOM OF BANK
- LOG VANE
- ROCK OR STONE
- ROOT WAD
- ROCK VANE
- CONSERVATION EASEMENT
- NOXIOUS INSECT POPULATIONS
- INVASIVE / EXOTIC VEGETATION
- THICK VEGETATION IN CHANNEL
- PHOTO POINT

LIGUSTRUM SINENSE, ALBIZIA JULIBRISSIN, LONICERA JAPONICA, ENCROACHMENT

AGGRADATION AND THICK VEGETATION IN CHANNEL

CROSS SECTION 2

TRASH IN CHANNEL

5004

5001

VEG. PLOT

5003

NOXIOUS INSECT POPULATIONS

VEG. PLOT

9900

CROSS SECTION 1

5002

LIGUSTRUM SINENSE, ALBIZIA JULIBRISSIN, LONICERA JAPONICA, ENCROACHMENT

VEG. PLOT

9920

MATCH LINE - SEE SHEET 2

WILLIAMS DAIRY ROAD

72" CMP INV. = 575.21

72" CMP INV. = 578.74

NORTH

GRAPHIC SCALE

40 0 20 40 80

1 inch = 40 ft.

SHEET 1 OF 4

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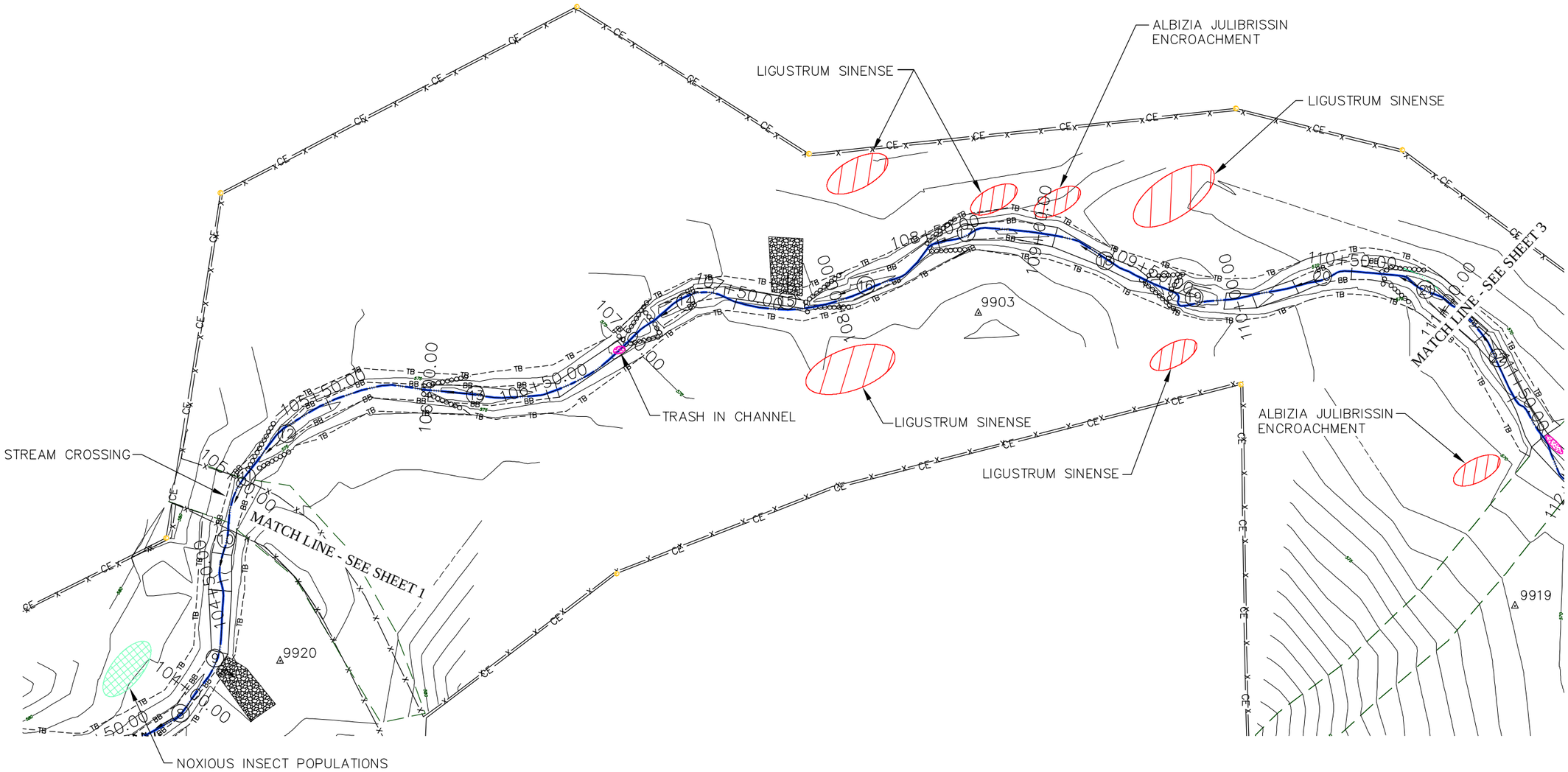
UT TO SANDY CREEK

STREAM RESTORATION PROJECT - YEAR ONE MONITORING

RANDOLPH COUNTY, NORTH CAROLINA

PROJECT NO.	EEP-08030
FILENAME:	EEP-08030X
SCALE:	1" = 40'
DATE:	11-05-08

McADAMS



NORTH

GRAPHIC SCALE

50 0 25 50 100

1 inch = 50 ft.

SHEET 2 OF 4

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UT TO SANDY CREEK

STREAM RESTORATION PROJECT - YEAR ONE MONITORING

RANDOLPH COUNTY, NORTH CAROLINA

PROJECT NO.	EEP-08030
FILENAME:	EEP-08030X
SCALE:	1" = 50'
DATE:	11-05-08

McADAMS

MATCH LINE - SEE SHEET 2

SIDE BAR IN CHANNEL

STREAM CROSSING

TRASH IN CHANNEL

ALBIZIA JULIBRISSIN ENCROACHMENT

LIGUSTRUM SINENSE, ALBIZIA JULIBRISSIN, LONICERA JAPONICA ENCROACHMENT

CROSS SECTION 4

9906

9919

VEG. PLOT

CROSS SECTION 6

CROSS SECTION 5

5007

5006

5005

5008

5009

5010

VEG. PLOT

VEG. PLOT

CROSS SECTION 3

MATCH LINE - SEE SHEET 4

ERODING BANKS

TYPHA LATIFOLIA ENCROACHMENT

AGGRADATION AND THICK VEGETATION IN CHANNEL

LIGUSTRUM SINENSE, ALBIZIA JULIBRISSIN, LONICERA JAPONICA ENCROACHMENT

NORTH

GRAPHIC SCALE

50 0 25 50 100

1 inch = 50 ft.

SHEET 3 OF 4

UT TO SANDY CREEK

STREAM RESTORATION PROJECT - YEAR ONE MONITORING

RANDOLPH COUNTY, NORTH CAROLINA

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PROJECT NO.	EEP-08030
FILENAME:	EEP-08030X
SCALE:	1" = 50'
DATE:	11-05-08

McADAMS

MATCH LINE - SEE SHEET 3

SAND BAR

LIGUSTRUM SINENSE, ALBIZIA JULIBRISSIN, LONICERA JAPONICA INCROACHMENT

AGGRADATION AND THICK VEGETATION IN CHANNEL

ALBIZIA JULIBRISSIN ENCROACHMENT

LIGUSTRUM SINENSE ENCROACHMENT

LIGUSTRUM SINENSE, LONICERA JAPONICA INCROACHMENT

LIGUSTRUM SINENSE ENCROACHMENT

9924

GRAPHIC SCALE

40 0 20 40 80

1 inch = 40 ft.

SHEET 4 OF 4

UT TO SANDY CREEK

STREAM RESTORATION PROJECT - YEAR ONE MONITORING

RANDOLPH COUNTY, NORTH CAROLINA

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McADAMS